



MARBLE BLUFF, ON THE LOUISVILLE AND NASHVILLE RAILROAD, GILMER COUNTY, GEORGIA.

GEOLOGICAL SURVEY OF GEORGIA

W. S. YEATES, State Geologist

BULLETIN No. 1

A

Preliminary Report

on the

Marbles

OF

GEORGIA

(Second Edition, Revised and Enlarged)

BY

S. W. McCALLIE

Assistant Geologist

1907

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of the
Geological Survey of Georgia
in the Year 1894

(Ex-Officio)

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LETTER OF TRANSMITTAL

(1st Edition)

STATE OF GEORGIA, GEOLOGICAL SURVEY

ATLANTA, GA., August 20, 1894

*To His Excellency, W. J. NORTHEN, Governor and President of
the Advisory Board of the Geological Survey of Georgia*

SIR: — I have the honor to transmit, herewith, the report of Mr. S. W. McCallie, Assistant Geologist, on "The Marbles of Georgia."

This is the first of a series of bulletins, intended to give the latest and most reliable information on the various subjects embraced in the economic geology of the State. As new information is to be expected, wherever development is undertaken, and, as new localities for minerals are liable to be found at any time, these economic reports are to be considered preliminary and subject to emendation, either by supplemental bulletins, or when the final reports on the general geology of the State shall be undertaken.

Very respectfully yours,

W. S. YEATES,

State Geologist.

LETTER OF TRANSMITTAL

(2d Edition)

GEOLOGICAL SURVEY OF GEORGIA,
ATLANTA, GEORGIA, June 20th, 1905.

*To His Excellency, JOSEPH M. TERRELL, Governor, and Chairman
of the Advisory Board of the Geological Survey of Georgia.*

SIR: — I have the honor to submit herewith for publication a revised and enlarged edition of Bulletin No. 1, on the Marbles of Georgia. This bulletin, issued from the press in the spring of 1895, was in such demand that the edition of 3,000 copies was soon exhausted, hundreds of copies being used by the producers of Georgia marbles in backing their claims, before architects and builders, that Georgia marble was one of the most beautiful and durable building stones on the American market. It is gratifying to be able to state that I have on file in my office letters from the presidents of the two oldest and largest marble-producing concerns in Georgia, testifying that, to their knowledge, the report of this Survey on the Marbles of Georgia was largely instrumental in securing some of the largest contracts in Georgia marble in this country. There continues to be great demand for this report.

The present edition has been partly re-written, and new material, in the form of statistics and new data recently collected in the field, has been introduced, besides a chapter on the serpentine deposits of Cherokee County, known to the trade as Verd Antique marble. Care has been taken to preserve the general character of the first edition; but a large number of half-tone plates have been introduced, to show the great increase in, and the present condition of, the industry.

Very respectfully yours,

W. S. YEATES,
State Geologist.

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¹ See the Pocket at the End of the Volume.

THE MARBLES OF GEORGIA

CHAPTER I

A HISTORICAL SKETCH OF THE DEVELOPMENT OF THE MARBLE INDUSTRY IN PICKENS COUNTY, GEORGIA

In 1840, Fritz T. Simmons began quarrying marble on a small scale; in Longswamp valley near Tate. This seems to have been the first systematic work, done in the county, toward developing the marbles. Previous to this time, however, the Cherokee Indians, who originally inhabited this section of the country, worked the marble, to a limited extent, into bowls and various other forms. A good specimen of this handiwork may still be seen, in the form of a large circular marble bowl, now used as a flower pot in the late Colonel Stephen Tate's yard, near the Southern and Piedmont quarries. It is remarkably well preserved, and was prized very highly by its owner.

The stone worked by Simmons is said to have been obtained from outcroppings and weathered boulders, exposed along the hillside, and was not always of the best quality. The impure and more or less laminated varieties were frequently selected, on account of the ease with which they could be worked. At first, all the work required in getting out and polishing the stone, which was then used exclusively for tombstones, was executed by hand. The great amount of manual labor thus spent on the stones, before they were ready for erection in churchyards, made them so costly, that only the wealthy were able to buy; and, as a result, the demand was so limited that only a few hands were necessary to supply the trade. About two years after Simmons began work, he erected a mill with one gang of saws, on the east branch of Longswamp creek, near Marble Hill post-office. This was the first mill put up in the county for sawing mar-

ble. This mill, as a whole, is said to have been a somewhat primitive affair; but the mode of cutting the marble was the same as is now employed in our best mills. A short time after this, another mill was built by Simmons and Hurlick on the west branch of Longswamp creek, two miles east of Jasper. It was run, though not continuously, for four or five years, when work in both the mill and the quarry located near by was temporarily suspended. Mr. Simmons, who had now associated with him, as a partner, Mr. Margum of Marietta, began work on a more extensive scale at the original quarry, near which the Southern Marble works are now located. The firm continued operations for only a few years; but, during that time, it got out a great many tombstones, many of which can be seen in churchyards throughout the surrounding country.

In 1850, Tate, Adkinson & Co. opened a quarry in the vicinity of the Georgia Marble works, and erected two mills on the creek, one above and the other below the quarry. Each mill had two gangs of saws, which enabled the company to turn out a greater amount of work than any previously organized. Owing to this increased facility for the production of marble, the firm now found it necessary to employ an agent to travel through the counties of North Georgia, to solicit orders for tombstones. When a number of these stones, sufficient to make a wagon-load, had been sold, a delivery wagon, drawn by six mules, was started out on the road, to deliver the stones to the respective buyers, as it traveled through the country. This mode of transportation, in a mountainous country, where the roads were usually rough and steep, added greatly to the original cost of the stone. Common, plain tombstones, that now bring from ten to twelve dollars per set, then sold at thirty or forty dollars. After continuing operations for only about two years, this firm was succeeded by Rankin, Summy & Hurlick, which was the last company to do any work, in the immediate vicinity of the Georgia Marble works; until the present company was organized. In 1854, Summy & Hurlick, who, ten years before, had opened a quarry two miles east of Jasper, again renewed the work at that place. They

erected there a mill with four gangs of saws, and continued successful operation for about six years, when the works were abandoned, on account of the Civil War. Immediately after the war, the quarry was worked by Robinson, Richardson & Besinger, for nearly two years; but it was afterward abandoned, until 1885, when the property fell into the hands of the Perseverance Marble Company, organized by Jas. P. Harrison and others. This company at once made a considerable outlay of money, in erecting a steam-mill, opening up new quarries, etc. Steam-drills and all the machinery necessary to carry on a first-class quarry were secured. The works, which now employed a number of hands, continued operations for only about three years, turning out, in the meantime, a great deal of marble, which was used for various purposes. Since then, the greater part of the machinery has been removed, and the buildings have become somewhat dilapidated.

THE GEORGIA MARBLE COMPANY was organized in May, 1884, with a capital of \$1,500,000. This date marks the beginning of a very important epoch, in the history of the development of the marble industry in Pickens county. Previous to this time, Georgia marble was practically unknown to the trade as a building-stone, and had even a very local use for tombstones, etc.; but, on account of the superior quality of the marble, and the energy and business-like methods of this and other companies soon organized, it has found its way to all parts of the United States, where it is now used in the construction of some of the most costly buildings. The first work of the Georgia Marble Company, after securing control of nearly seven thousand acres, was to construct and equip a branch railroad from the quarries to the main line of the Marietta and North Georgia Railroad.¹ This gave ready means of transportation to all parts of the country. The mills and quarries were then put in operation, at a total cost of nearly \$800,000, and have been run continuously ever since, with a gradually increasing output.

THE SOUTHERN MARBLE QUARRIES were opened in 1885 by Miles & Horne, contractors for the State capitol of Georgia. The stair-

¹ Now the Atlanta, Knoxville & Northern Division of the Louisville & Nashville R. R.

case and the tiling, except the border tiles, used in this building, were secured at these works. Since then, the facilities for quarrying and working the marble have been greatly increased. New quarries have been opened, and mills erected; and great quantities of white marble have been annually shipped to all sections of the country for monumental work and interior finish. During the same year, in which the Southern marble quarries were opened, Geo. B. Sickels & Co., marble dressers, near Tate, began work. This firm has since gradually increased its output, from year to year, until it has built up an extensive trade in tiling and interior decoration.

THE PIEDMONT AND THE BLUE RIDGE MARBLE COMPANIES were both organized in 1886. The former opened a quarry and erected a large mill near the Southern works; but, for some reason, the works have not been continuously operated. Since the first edition of this bulletin was issued, the Piedmont Marble Company, having become involved in litigation, has sold its property to the Marble Hill Company, which has recently leased its plant to the Blue Ridge Marble Company. The quarries are not at present in operation.

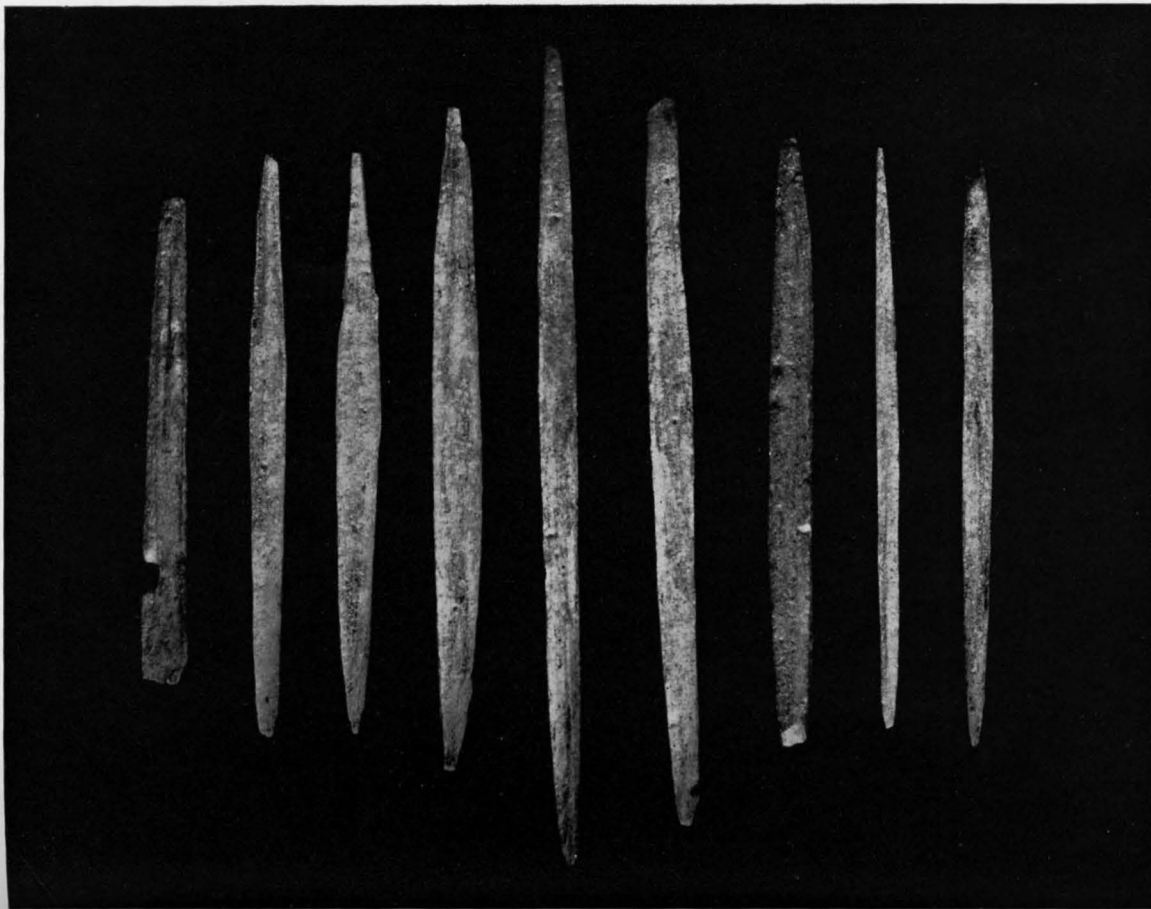
PRODUCTION

The following table, taken from the report on the "*Mineral Resources of the United States*," U. S. Geological Survey, for 1903, shows that Georgia produces more marble than any other State in the Union with the exception of New York and Vermont:—

MARBLE

The marble production of 1903 was valued at \$5,362,686, an increase of \$318,504 over the value for 1902, which was \$5,044,182. Arkansas and Montana had no output in 1903; but North Carolina was added to the list of producers. The increase was from the quarries in New York and Vermont; the production in the other States decreased somewhat.

Strikes in the building trade affected the marble industry as well as the other branches of the stone business.



STRETCHED PEBBLES, FROM THE SCHISTOSE CONGLOMERATE ALONG THE MARBLE BELT IN GILMER COUNTY, GEORGIA.

BEGINNING OF THE MARBLE INDUSTRY

The following table shows the value of the marble produced in the United States from 1899 to 1903, inclusive, by States: —¹

Value of Marble, by States, from 1899 to 1903, inclusive.

State	1899	1900	1901	1902	1903
Alabama.....		\$ 500		(a)	(a)
Alaska.....			\$ 4,500		
Arizona.....		5,000	300		(x)
Arkansas.....	\$ 3,410		300	(a)	
California.....	6,500	17,500	6,642	\$ 92,298	\$ 78,329
Colorado.....	10,776				
Connecticut.....				(a)	(a)
Georgia.....	742,554	681,241	936,549	660,517	565,605
Idaho.....		1,250			
Maryland.....	77,000	70,000	68,100	(a)	83,672
Massachusetts.....	59,416	180,735	126,546	165,489	154,228
Missouri.....		900	2,100		(a)
Montana.....		1,200	1,500	(a)	
New Mexico.....		4,500	10,600	(a)	(a)
New York.....	338,816	332,518	379,159	577,298	748,160
North Carolina.....					4,865
Oregon.....			500		
Pennsylvania.....	139,506	151,167	157,547	160,423	98,200
Tennessee.....	b 384,705	424,054	494,687	518,256	485,905
Utah.....	2,355		820	(a)	3,200
Vermont.....	2,241,806	2,484,852	2,758,583	2,628,164	3,011,505
Washington.....	4,837	11,836	22,816	61,176	40,117
Wyoming.....					3,100
Other States.....				c 180,561	d 91,300
Total.....	4,011,681	4,267,253	4,965,699	5,044,182	5,362,686

a Included in Other States.

b Contains small amount from North Carolina.

c Includes Alabama, Arkansas, Connecticut, Maryland, Montana, New Mexico and Utah.

d Includes Alabama, Arizona, Connecticut, Missouri, and New Mexico.

The following table shows the various uses to which the marble quarried in 1899, 1900, 1901, 1902 and 1903 was put: —¹

Distribution and Value of Output of Marble in 1899, 1900, 1901, 1902 and 1903 among Various Uses

Use	1899	1900	1901	1902	1903
Sold by producers in rough state..	\$ 640,535	\$ 491,813	\$ 591,667	\$ 2,276,629	\$ 2,454,263
Dressed for building.....	1,176,208	1,080,969	1,236,023	1,038,102	1,111,072
Ornamental purposes.....	92,942	13,754	126,576	7,300	51,359
Dressed for monumental work.....	1,650,155	2,019,474	1,948,392	956,870	1,062,339
Interior decoration in buildings...	389,040	555,092	1,008,432	679,913	663,553
Other uses.....	62,801	106,151	54,059	85,268	20,100
Total.....	4,011,681	4,267,253	4,965,699	5,044,182	5,362,686

The following table shows the value of the marble produced in the United States in 1902 and 1903, by States and uses: —

¹ For the years 1904 and 1905 see Appendix.

BEGINNING OF THE MARBLE INDUSTRY

Value of the Marble Product, by States and Uses, 1902 and 1903¹

1902

State	Rough			Dressed					Other purposes	Total
	Build- ing	Monu- men- tal	Other	Build- ing	Monu- men- tal	Orna- men- tal	Inter- ior deco- ration	Other pur- poses		
Alabama.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Arizona.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Arkansas.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
California.....	\$13,400	\$98	\$19,700	.....	\$4,000	\$100	\$55,000	.....	.....	\$92,298
Connecticut.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Georgia.....	350,000	166,017	81,000	\$50,000	7,500	.....	6,000	.....	.....	660,517
Maryland.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Massachusetts.....	51,695	.....	.....	81,394	.....	6,000	15,056	.....	\$11,344	165,489
Missouri <i>b</i>.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Montana.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
New Mexico.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
New York.....	83,230	75,342	8,433	267,013	143,080	200	.....	.....	.....	577,298
Oregon <i>b</i>.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pennsylvania.....	22,446	.....	.....	110,977	24,000	.....	.....	.....	3,000	160,423
Tennessee.....	227,337	26,000	4,500	.....	9,000	.....	240,419	\$11,000	.....	518,256
Utah.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Vermont.....	353,534	677,523	25,070	433,265	753,390	.....	321,639	53,888	.....	2,623,164
Washington.....	7,000	.....	.....	31,873	.....	.....	19,200	1,000	.....	61,176
Other States <i>c</i>	36,997	40,819	2,103	63,780	10,900	1,000	22,549	336	1,000	180,561
Total.....	1,146,639	985,804	3,180	1,038,302	956,870	7,300	679,913	71,024	15,244	5,044,182

1903

Alabama.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Arizona.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Arkansas.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
California.....	\$ 6,879	.....	.....	\$ 20,000	\$ 1,200	.....	\$ 48,000	\$ 2,000	\$ 250	\$ 73,329
Connecticut.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Georgia.....	271,432	\$198,223	\$50,000	25,000	.....	\$ 18,000	2,950	.....	.....	65,605
Maryland.....	28,180	25,065	30,427	.....	.....	.....	.....	.....	.....	83,672
Massachusetts.....	5,337	.....	5,000	134,600	.....	2,400	6,841	.....	.....	154,228
Missouri.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
Montana.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Mexico.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	(a)
New York.....	195,506	64	7,595	356,561	179,434	.....	.....	.....	.....	748,160
North Carolina.....	.....	4,365	.....	.....	.....	.....	.....	.....	.....	4,365
Oregon <i>d</i>.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pennsylvania.....	5,090	200	194	56,866	27,000	.....	.....	.....	3,850	93,200
Tennessee.....	94,500	15,000	125,279	134,226	3,500	.....	99,600	13,700	100	485,905
Utah.....	200	3,000	.....	.....	.....	.....	.....	.....	.....	3,200
Vermont.....	435,990	649,837	227,400	280,053	847,253	18,350	502,062	.....	.....	3,011,505
Washington.....	7,500	800	.....	14,761	3,347	12,009	1,000	200	.....	40,117
Wyoming.....	.....	.....	.....	.....	.....	.....	3,100	.....	.....	3,100
Other States <i>e</i>	6,400	.....	4,700	80,000	100	100	.....	.....	.....	91,300
Total.....	1,107,064	896,604	450,595	1,111,072	1,062,339	51,359	663,553	15,900	4,200	5,362,636

a Included in Other States.*b* Production of Missouri and Oregon included under report on limestone.*c* Includes Alabama, Arkansas, Connecticut, Maryland, Montana, New Mexico and Utah.*d* Production of Oregon included under report on limestone.*e* Includes Alabama, Arizona, Connecticut, Missouri and New Mexico.¹ For the years 1904 and 1905, see Appendix.



A VIEW OF THE SCHISTOSE CONGLOMERATE, OCCURRING ALONG THE MARBLE BELT IN GILMER COUNTY, GEORGIA

CHAPTER II

THE ORIGIN OF LIMESTONES

In order that the general reader may better understand the position and mode of occurrence of the Georgia marbles, it is thought advisable to give a short sketch of the origin of limestones. The term limestone embraces all calcareous rocks, however soft or hard. It includes the soft, friable chalks, as well as the hard, crystalline marbles.

Limestones have been formed, either as a precipitate from a saturated solution of calcium carbonate, or from the remains of shells and skeletons of animals. It has been the prevailing opinion, among scientific men, until recently, that all extensive calcareous formations have resulted from the debris of organisms. This opinion is now considered by some of our leading geologists to be far too sweeping, and they have presented many facts, which make it quite probable that many of our limestones are partly, and some of them, entirely, due to chemical precipitation.

The everglades of Florida are said to present favorable conditions, for the deposition of calcareous matter from chemical solution. They form an extensive swamp, with an area of several hundred square miles, elevated only a few feet above the sea-level. During the rainy season, the swamp is submerged by the swollen rivers, which flow into it. The waters of these rivers, collected from soils where vegetable matter is undergoing decomposition, contain much carbonic acid, which enables them to take into solution a great deal of calcium carbonate, dissolved from the calcareous rocks, over which they flow. In the dry season, the water of the swamp, exposed to the rays of a subtropical sun, undergoes a rapid evaporation, and deposits calcium carbonate, both as a calcareous mud and in a crystalline form. The deposit extends over a considerable area, almost

horizontal; and, if the conditions, now in existence, were to continue, for a long period of time, the formation would attain a thickness of many feet, and would require only to be consolidated, in order to form an extensive bed of what is commonly called limestone.

Many of the rivers, flowing into the Mediterranean sea, also deposit on the sea bottom, opposite their mouths, calcium carbonate as a chemical precipitate. The calcareous deposit is especially abundant at the mouth of the river Rhone, and has been pointed out, by Sir Charles Lyell and others, as an example of hard, compact, calcareous rock, now in process of formation. There may be seen, in the Museum of Montpellier, France, a cannon taken from the sea bottom, near the mouth of this river, embedded in a crystalline calcareous rock, that shows both the character and the recent origin of the deposit.

In all countries, limestone is being deposited, as a chemical precipitate, about the outlet and along the course of limestone springs. Probably the best examples of this mode of forming calcareous rocks are to be found in France and Italy, where, at places, large areas are covered to the depth of many feet by the deposit. In this country, we are having similar deposits laid down by the "Old Sweet" and the "Red Sweet" springs of Virginia; and, also, by numerous springs in California and the Yellowstone region. Notable are the deposits made by the celebrated Mammoth Hot Springs in the Yellowstone National Park, where immense deposits of calcareous tufa are rapidly forming. The rocks thus formed are not usually very extensive, as compared with other deposits; but, nevertheless, they are frequently important, from an economic standpoint. Owing to the peculiar condition, under which they are formed, they often show quite a variety of colors arranged in bands, which make the stone very valuable for ornamental purposes, when sufficiently compact. The so-called California, Missouri, Arizona and Mexican onyx, calcareous stones of remarkable beauty, were probably deposited in this way.

Limestone, resulting from chemical precipitation, appears to be confined, at present, almost entirely to land-locked lagoons, bays and

running streams; but, during the earlier geological times, when the earth's crust was at a much higher temperature, it was probably deposited more or less abundantly in the open sea. This seems to be the only explanation, for limestones being found in Archæan areas.

Animals, from a very early period in the history of the earth, have been the most effective agents in the formation of limestone. They have worked continuously in the waters of all latitudes, extracting from the sea-water the calcareous matter carried down by rivers, and forming it into hard shells and skeletons. The accumulation of their remains, in the course of generations, formed thick beds, extending over wide areas. If these remains accumulated in a bay or estuary, where they were protected from the action of the waves, the rock resulting from their consolidation would consist of a mass of shells and skeletons, probably cemented together by a thin layer of calcareous mud. On the other hand, if they accumulated on an exposed coast, the waves would pulverize them into a fine powder, which, when consolidated, would form a compact limestone, rarely showing any trace of the shells, from which it was formed.

Along the southern coast of Florida, immense beds of limestone are now in process of formation from the remains of animals. There, as elsewhere in all temperate and tropical seas, the most active lime-producing animals are the corals. All the southern portion of that State has been formed, mainly, from the débris of these organisms, which are still extending it seaward.

The conditions for the rapid growth of these animals appear to be even more favorable about the islands of the South Pacific, where thousands of square miles of the ocean's bed are covered to the depth of many feet by their remains, which in many places have become so hard and compact, as to form calcareous rocks, difficult to distinguish from the more ancient limestones.

On submarine banks and in shallow seas, not suitable for the growth of corals, echinoderms, crustaceans and mollusks live in great numbers. The hard parts of these animals, being principally calcium carbonate, are piled up, in process of time, into extensive

heaps, which gradually become consolidated into rock, sufficiently firm for building purposes, although many of the shells may still retain their original structure and delicate markings.

In the deep sea, there exist, near the surface of the water, myriads of microscopic organisms, whose calcareous skeletons are continually falling to the bottom, where they form at places a thick deposit of ooze, closely resembling pulverized chalk. Recent investigations show that deep-sea ooze and chalk are almost identical, and were likely deposited under similar conditions, as the remains of very minute animals.

All limestone, making up a portion of the earth's crust, has been made by the same chemical or organic agencies, which are still in operation, forming calcareous deposits. So completely has this fact been established, that, in many instances, the whole series of changes can be traced from the loose heap of shells on the sea bottom to the hard crystalline marbles on the mountain side. These, as well as all other sedimentary deposits, when first laid down in the ocean by the action of water, were originally horizontal; and, if the existing conditions had not changed, they might have continued to increase indefinitely, both in thickness and extent. The crust of the earth, however, was very unstable, and underwent, from time to time, great changes, which brought about corresponding changes in the nature of the deposits. Clear seas, once teeming with innumerable lime-producing animals, were gradually changed into muddy seas, depositing clay, sand and gravel. These various sediments, together with the calcareous beds, were many times repeated, until they attained an aggregate thickness of many thousand feet. Then, lateral pressure, which had been increasing for ages, as the earth contracted from the loss of heat, caused the horizontal beds to be slowly raised above the surface of the ocean, and sometimes to be bent into gigantic folds, forming alternate valleys and ridges. So powerful were these lateral forces in many cases, that the folds overlapped one another, or broke and relieved the tension, by thrusting one edge of the series of strata far over the other.



A CUT ALONG THE AMICALOLA RAILROAD, SHOWING THE COUNTRY ROCK (MICA-SCHIST) OF THE MARBLE DEPOSITS OF PICKENS COUNTY, GEORGIA.

During sedimentation and upheaval, heat, pressure and chemical action almost universally changed the deposit into compact rocks, such as are now to be seen outcropping on nearly every hillside in North Georgia. As soon as these indurated deposits were elevated above the sea-level, atmospheric and aqueous agencies began their work of erosion and transportation. The folds, forming high ridges and even mountains, were often cut away by these agents into valleys, while the valleys remained as ridges. The original natural features of the country were thus, in many cases, completely changed, and the former topography can now be worked out, with any degree of certainty, only after a thorough knowledge of the structural geology of the region. No section of the country, probably, better illustrates this advanced stage of folding and erosion, than that portion of North Georgia, in which the beds of crystalline limestones, or marbles, appear. Here the various contorted and folded strata of slate, gneiss, conglomerate and marble, once horizontal beds of clay, sand, gravel and calcareous material in the bottom of the sea, now dip at an angle from 20° to 70° to the southeast. This direction of dip is practically the same throughout the marble belt, and is evidently due to close pressed, overlapping folds, with their upper portion removed by erosion. As the relative positions of the different beds of rocks in a fold always remain unchanged, it is possible to trace certain strata, as marble, long distances, without ever seeing any actual outcrop, and even to identify a stratum as belonging to the same geological horizon, though the outcroppings may be many miles apart. Where marbles underlie valleys covered to considerable depths, as in North Georgia, this is the only way that they can be located, with any degree of certainty; and the prospector who disregards these facts usually retires from the field with only a large fund of valuable experience as a reward for his labor.

Limestones, resulting either from chemical precipitation or from the remains of animals, differ greatly, both in chemical and physical properties. These differences have given rise to many varieties; the principal ones are described below:—

Common Limestone is a compact, massive rock, occurring in beds or layers, with other sedimentary deposits, and is the most abundant of all the calcareous rocks. Its color is commonly yellowish gray, blue, or brown; but it may be black, or even red. It, like all other rocks of this class except dolomite, effervesces readily with dilute hydrochloric acid, burns readily into quicklime, and may or may not contain animal remains. Most common limestones are crypto-crystalline.

Marble, which is the special subject of this report, differs from the common limestone only in being pheno-crystalline. It is made up of crystalline grains of a uniform size, but usually of no definite shape; these may readily be seen with the naked eye, as the name pheno-crystalline implies. When free from foreign substances, marble is of a snow-white color; but, if accessory minerals are present, the stone may be red, blue, yellow, gray, green, or black. This great variety of colors well adapts it for all classes of ornamental work. It occurs, like common limestone, in immense beds, sometimes hundreds of feet in thickness and many miles in length; but, unfortunately, only a small proportion of such deposits furnish stone of any economic value. Marble is regarded by many geologists as a metamorphic rock. It has, in most cases, been produced, probably, from common limestone, by means of heat and pressure.

Magnesian Limestone (dolomite) is a very abundant calcareous rock, closely resembling common limestone, in all its physical properties, but having a different chemical composition. When pure, it is composed of nearly equal parts of calcium carbonate and magnesium carbonate; and, unless heated, it does not readily effervesce with dilute hydrochloric acid. Magnesian limestone occurs both as a pheno-crystalline and a crypto-crystalline rock. When pheno-crystalline, it is called dolomitic marble. It makes a fine stone, either for ornamental or for architectural purposes. The crypto-crystalline form of this rock occurs in Northwest Georgia as Knox dolomite, where it forms a number of wide, more or less parallel bands, extending in a diagonal direction across the corner of the State. It has

been used at several places for bridge piers, retaining walls etc.; but, as it does not admit of a fine polish, it cannot be used for ornamental purposes. The crystalline form appears as a true dolomitic marble, at various places along the marble belt in Pickens, Gilmer and Fan-nin counties.

Oölitic Limestone consists of small, more or less spherical grains of calcite, cemented together by similar material; it resembles somewhat the roe of a fish, receiving its name from this resemblance. The individual grains have a concretionary structure, which has resulted from the peculiar conditions, under which they were deposited. The better qualities of the stone are well adapted for building purposes. The State capitol of Georgia is constructed of this variety of limestone, from Indiana.

Crinoidal Limestone is made up almost entirely of crinoidal stems, corals etc. It is frequently semi-crystalline; and, when variegated, as the Tennessee marble, it makes a remarkably fine ornamental stone.

Travertine is deposited, as a chemical precipitate, by springs or streams, and varies greatly in color and texture. Its color is usually white or some shade of brown, green, red, or yellow. In the more compact varieties of the stone, as the so-called Mexican onyx, these different colors alternate with each other, producing a beautiful banded structure. When travertine is deposited in water much agitated, it is quite spongy and porous, and has no economic value, either as a building or ornamental stone. This variety is called tufa. *Stalactites and stalagmites*, cave deposits, have an origin similar to that of travertine.

Hydraulic Limestone is an impure calcareous rock of various colors, found more or less abundant in all geological formations. It contains clay and silica, which are often found in such abundance, that when the rock is burnt for lime, it will not slack with water; but, when ground and mixed as a mortar, it will set under water, and form a mass of great hardness. Hence it is called hydraulic limestone. The best varieties of this stone are generally found as tran-

sitional beds between ordinary limestones and shales or sandstones.

Chalk is a fine-grained, earthy limestone, so soft as to readily soil the hands. It often encloses nodules or bands of flint; and, when examined through the microscope, it is frequently found to be made up largely of shells of very minute animals.

Lithographic Limestone is a very compact, fine grained homogeneous calcareous rock, usually of a pale-gray or yellowish color, with a sharp conchoidal fracture. It is extensively used by lithographers for making maps etc. On the smooth surface of such a stone, drawings are made with a greasy ink, specially prepared for the purpose; or such a drawing may be transferred to the stone directly from the original drawing. The stone, being somewhat porous, retains the ink; and, if it is now moistened with water, all parts of the stone become wet, except where the grease occurs. A roller, coated with printer's ink, is then passed over the stone, taking effect only on the greased lines of the drawing, which may then be printed from, as from an engraving. There are only a few places, so far discovered, within the United States, where limestone occurs, possessing the necessary qualities for lithographic purposes, nearly all of it, at present, being imported from Solenhofen, Bavaria.

Bituminous or Fetid Limestone is usually of a very dark color; and, when struck with a hammer, it gives off a very disagreeable odor, which appears to be due to the carbonaceous material it contains. When exposed to the atmospheric agencies for any length of time, it undergoes a change in color, frequently becoming almost white on the exposed surface. The so-called black marbles of Cedar Ridge, Whitfield county, are good examples of bituminous limestone.



A MARBLE QUARRY NEAR MINERAL BLUFF, FANNIN COUNTY, GEORGIA.

CHAPTER III

GEOGRAPHY AND PHYSIOGRAPHY

All of the marbles of Georgia, which have so far been worked on a commercial scale, occur along the Louisville & Nashville R. R., in the northern part of the State. They are confined to a narrow belt, about sixty miles long and from one to three miles wide, traversing in a southwesterly direction the counties of Fannin, Gilmer, Pickens and Cherokee. That portion of the counties, in which the marbles are found, is usually quite hilly; and, in places, it becomes even mountainous, with peaks reaching an altitude of more than 4,000 feet above sea-level. The average elevation of the region is only about 1,500 feet.

The small valleys, which are numerous, are narrow, and always bounded on each side by steep hills or ridges. In many instances, the marbles form the floor of these valleys; but, more frequently, they occur along the adjacent hill-slopes, where they often form bold bluffs from 40 to 50 feet in height. The general trend of the ridges and valleys is northeast and southwest, conforming in direction to the strike of the rocks of the region; however, in some cases, as in the vicinity of Marble Hill, the course of the valleys and ridges may vary considerably from the general northeast and southwest trend. Such changes, however, are always local; and they occur only at a few points throughout the marble belt.

The streams, that traverse the valleys of the marble belt are usually small; nevertheless, they are always rapid, and often furnish ample power for operating grist-mills and other machinery. Some idea may be had of the rapidity of these streams, when it is stated that the fall is frequently 75 feet or more per mile. The most important streams are Long Swamp, Tolona and Turniptown creeks. At many places along these streams, the valleys in which they flow

often become suddenly contracted, thus forming narrow deep gorges, where storage dams for water-powers may be constructed at small cost. In general, the topography of the marble belt may be said to be that, commonly met with throughout the Southern Appalachian region, where the streams are rapidly deepening their channels in rocks of variable hardness.

GEOLOGY

The holo-crystalline marbles, described in this report, are found in what is known as the Metamorphic or Crystalline Area of the State. They occur in a belt parallel with, and about 15 miles distant from, the western margin of this area. The rocks associated with the marbles are chiefly of sedimentary origin; though there occur in places, also rocks of igneous origin. The sedimentary rocks include the clay slates, the mica-schist or mica-slates, the quartzites and conglomerates, and the gneisses.

THE CLAY SLATES. — These vary in color from gray to black; and, in places, they seem to possess all the necessary qualities of a roofing-slate. The cleavage, which is often quite perfect, appears to conform, in all cases, to the original bedding. They contain more or less pyrite and graphite. The latter mineral is especially abundant in the darker slates, and is, no doubt, the chief cause of the dark color. The clay-slates are best developed on the west side of the marbles. East of the marbles, they seem to be replaced by the mica-slates or mica-schists. This change is probably due to a more complete metamorphism to the eastward.

THE MICA-SCHIST OR MICA-SLATES. — This type of rock is far more abundant than the clay-slate, and is the one most frequently found in immediate contact with the marbles. These rocks are made up largely of mica and quartz; but, in some places, they contain a large proportion of accessory minerals, the most abundant being garnets. A further study of these crystalline schists will no doubt show, that, in addition to the true mica-schists or mica-slates, they also include sericitic and chloritic schists.

THE QUARTZITES AND CONGLOMERATES. — The quartzites and conglomerates form but a small proportion of the sedimentary rocks occurring in the marble belt. They are of special interest, however, from their influence on the topography; since they are always ridge-forming. They are, furthermore, of special interest; as they show, by their stretched granules and pebbles, the intense dynamic action, to which the rocks of the region have been subjected. In nearly all places, where these quartzites or conglomerates have been examined, they show a more or less schistose structure. The water-worn quartzite pebbles have, in some instances,¹ been drawn out in the form of flattened rods, whose lengths exceed the original diameters of the pebbles by more than fifteen times. The matrix, in which the elongated pebbles are embedded, consists chiefly of mica with a few more-or-less rounded particles of kaolin. The latter appear to have been originally feldspar pebbles, which, for some reason, seem not to have been elongated during the metamorphism of the conglomerates.

THE GNEISSES. — These rocks, which are frequently met with throughout the marble belt, may be divided into coarse-grained and fine-grained gneisses. The former seem to have been originally pegmatite or coarse-grained granite; while the latter have the appearance of metamorphosed clastics. The coarse-grained gneisses, where they have been sheared, resemble very closely the above described schistose quartzites or conglomerates. Both varieties of the gneisses always contain garnets in greater or less quantity, and other accessory minerals. This type of rock rarely or never occurs in immediate contact with the marble; but, at some points, as in the vicinity of Marble Hill, it occurs only a short distance from the marble outcrops.

THE IGNEOUS ROCKS. — The igneous rocks associated with the marbles are pegmatites and hornblende rock. The former occurs in the form of dikes, and the latter, as intrusive masses or sheets. Both these classes of igneous rock are rare, and occur at only a few places. The hornblende rock, or what may be termed an amphibolite, is a dark, massive, coarse-grained rock, made up of greenish hornblende

¹ See plates II and III.

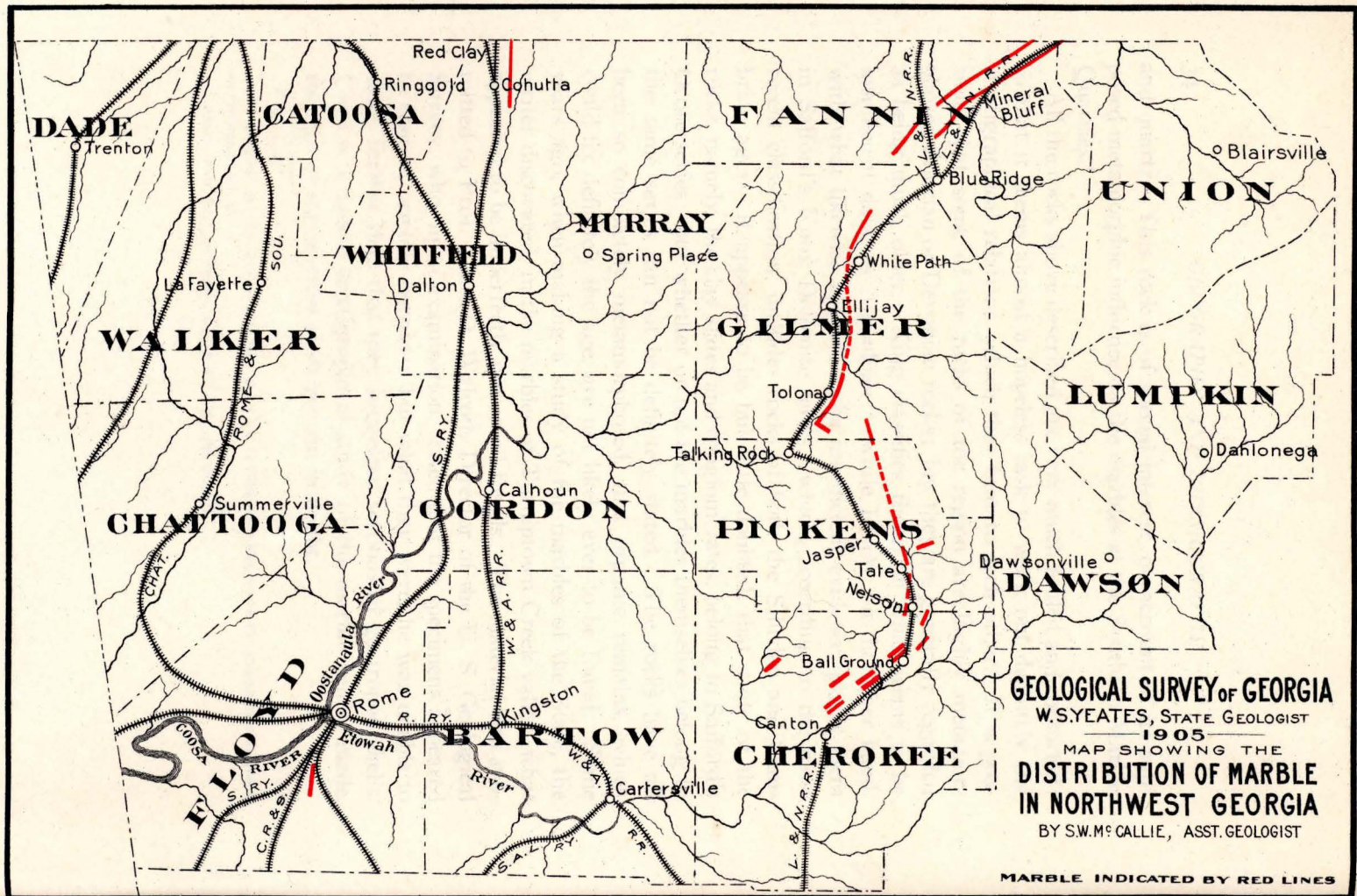
and quartz. This rock is of special interest, on account of its supposed metamorphic influence on the marbles at the Southern Marble Quarries.¹

All the rocks above described are very much folded and contorted; so that it seems almost a hopeless task to work out definitely the stratigraphical relations, which they bear to each other. It is possible, that some of the rocks of the region are highly metamorphosed Silurian or Devonian rocks; but they are generally regarded as being much older. King classifies them, on what seems to be insufficient data, as Algonkian;² while Elliott, on the other hand, with what likewise appears to be insufficient evidence, places them in Safford's Knox Dolomite series,³ which, according to the most recent classification, includes rocks of both the Silurian and Cambrian ages. It appears to be but little doubted, that some of the rocks, namely, the clay slates and conglomerates, belong to Safford's Ocoëe series; but whether or not the marbles themselves belong to the same series can not be definitely stated. The rocks have all been so completely metamorphosed, that organic remains, which could fix definitely the age, are not likely ever to be found. Some years ago, when making a study of the marbles of the State, the writer discovered, in the marbles of Turniptown Creek valley, what appeared to be imperfectly preserved fossils. The material was submitted to Prof. Chas. D. Walcott, Director of the U. S. Geological Survey, who, upon examination, stated that the specimens appeared to contain organic remains; but what they were, he was unable to state, further than that they suggested sections of gastropod shells. Until a complete stratigraphical study of the marble belt is made, the age of the marbles must remain in doubt.

¹ See p. 54.

² Geological Survey of Georgia, Bul. No. 2, a Preliminary Report on the Corundum Deposits of Georgia, 1895, p. 69.

³ Amer. Jour. Sc., 3rd Series, Vol. XXV, 1883, pp. 282-298.



GEOLOGICAL SURVEY OF GEORGIA
 W.S. YEATES, STATE GEOLOGIST
 1905
 MAP SHOWING THE
DISTRIBUTION OF MARBLE
IN NORTHWEST GEORGIA
 BY S.W.M. CALLIE, ASST. GEOLOGIST

MARBLE INDICATED BY RED LINES

CHAPTER IV

THE MARBLES OF FANNIN COUNTY

THE HAME STRING CREEK PROPERTY

The marbles enter the extreme northeastern portion of Fannin county from North Carolina in two almost parallel lines of outcroppings, located about two miles apart, and extending in a diagonal direction across the county. The line of outcropping, lying furthest to the east, makes its first appearance on the head-waters of HAME STRING CREEK (*lot 45, 8th district, 1st section*), a small stream flowing to the northeast, and emptying into the Notteley river. The exposure here is at the juncture of two small ravines, and consists of a few large bowlders of disintegration, with their surface much weathered. Nothing has been done towards the development of this property, and but little is known of the general character and extent of the deposit. The specimens secured are made up of small crystalline grains, and are of dark or light gray color. There is almost an entire absence of the mica, which produces the laminated structure, so frequently seen in many of the fine-grained marbles of North Georgia.

The rocks, associated with the marbles on the east, are gneisses, interstratified with thin beds of metamorphic sandstone, and give rise to a series of high ridges and knobs, extending as far south as Hemptown creek. The rocks, associated with the marbles on the west, are greenish hydro-mica slates, overlain by gneisses and mica-schist, forming the less elevated ridges and hills, that separate the two lines of marble outcroppings.

The dip of the rocks here, as elsewhere throughout the marble belt of Fannin county, is generally to the southeast, at an angle of from 30° to 70°, though they are subject to many local changes.

THE POLK PATTERSON PROPERTY

ONE MILE SOUTHEAST OF THE ABOVE EXPOSURE, and on the same creek, marble again outcrops on the *Polk Patterson property*. It, here, underlies, for nearly a quarter of a mile, the narrow valley at the western base of High Top mountain, and is one of the most extensive surface exposures in Fannin county. In the upper, contracted portion of the valley, covered with a virgin forest, the marble appears on the surface, on both sides of the creek, forming considerable ledges; but, lower down the valley, where the land is under cultivation, it is found, only by sinking pits from eight to ten feet beneath the surface of the alluvial soil. The angle of the dip and the width of the exposure at this point indicate that the deposit must be at least eighty feet thick, and that it is evidently a continuation of the marble outcropping on lot 45, mentioned above. A limited amount of work has been carried on here, to ascertain the extent and character of the stone, and, also, to secure specimens for exhibition. These specimens have always attracted the attention of men interested in marbles. A large slab of this stone, which was sent to the Piedmont Exposition at Atlanta in 1882, was said to have been an object of general comment. Light or dark gray, more or less banded with black, are the prevailing shades; but marble of a flesh color, tinged with green, and resembling very closely the Etowah marble, occurs. The crystalline grains are small, of a uniform size, and firmly united, which makes the stone susceptible of a high polish. In the light colored variety, chalcopryite, in small crystals, and a few scales of mica are found; but neither, probably, exists in sufficient abundance to seriously injure it for architectural purposes. The exposed surfaces of the stone generally show a uniform mode of weathering; and, wherever the outcroppings were examined, they indicated that the deposit is comparatively free from seams and cutters; however, its general soundness cannot be determined definitely until further prospecting has been done.

J. M. GARRISON'S PROPERTY

ON J. M. GARRISON'S PROPERTY (*lot 79, 8th district, 1st section*), one and a half miles southwest of the Patterson property, marble is



AN OUTCROP OF WHITE MARBLE AT THE PERSEVERENCE QUARRY, 2 MILES EAST OF JASPER,
PICKENS COUNTY, GEORGIA.

found near Cutcane creek, a small stream flowing parallel with, but in opposite direction to, Hame String creek. The marble located here is near the center of a narrow hollow, between two rather steep hills, and was accidentally discovered by a boy, while engaged in digging a pit. It lies beneath about five feet of earth, which appears to have been washed from the hillside above. At the time of our visit, only one excavation had been made, at which the marble could be examined. The color and general appearance of the stone are very similar to the marbles previously examined along this line of outcropping, differing only in being somewhat of a coarser texture. Nothing definite, concerning the extent and soundness of the stone, could be ascertained from the limited exposure. Small pieces of talc are of common occurrence in the soil overlying the marble; but it is not known, whether its original source is the marble or the associated gneisses and slates.

THE GRAY PROPERTY

IN THE IMMEDIATE VICINITY OF CUTCANE POST-OFFICE, *on lot 112, 8th district, 1st section, owned by J. L. Gray*, marble occurs in the creek bottoms, overlain, from four to five feet, by alluvial soil. It has been used to a limited extent in making lime for local consumption; but no regular quarrying has been attempted. A diamond-drill hole has been put down here in the marble to the depth of several feet; but it was impossible to secure any reliable information, as to the character of the stone penetrated.

Much of the prospecting in North Georgia has been done by speculators, who, unfortunately for the public, have kept the results of their work a secret; and, consequently, a great deal of the information concerning the marble deposits, which would otherwise be very valuable, is, at present, not obtainable for publication.

The area, over which the marble has been found on this property, is quite limited, having been discovered, so far, at only two or three places. By thoroughly prospecting the creek bottoms, it is likely that it will be found to be more extensive. The specimens of the stone collected are uniformly of a white or light-gray color, with an

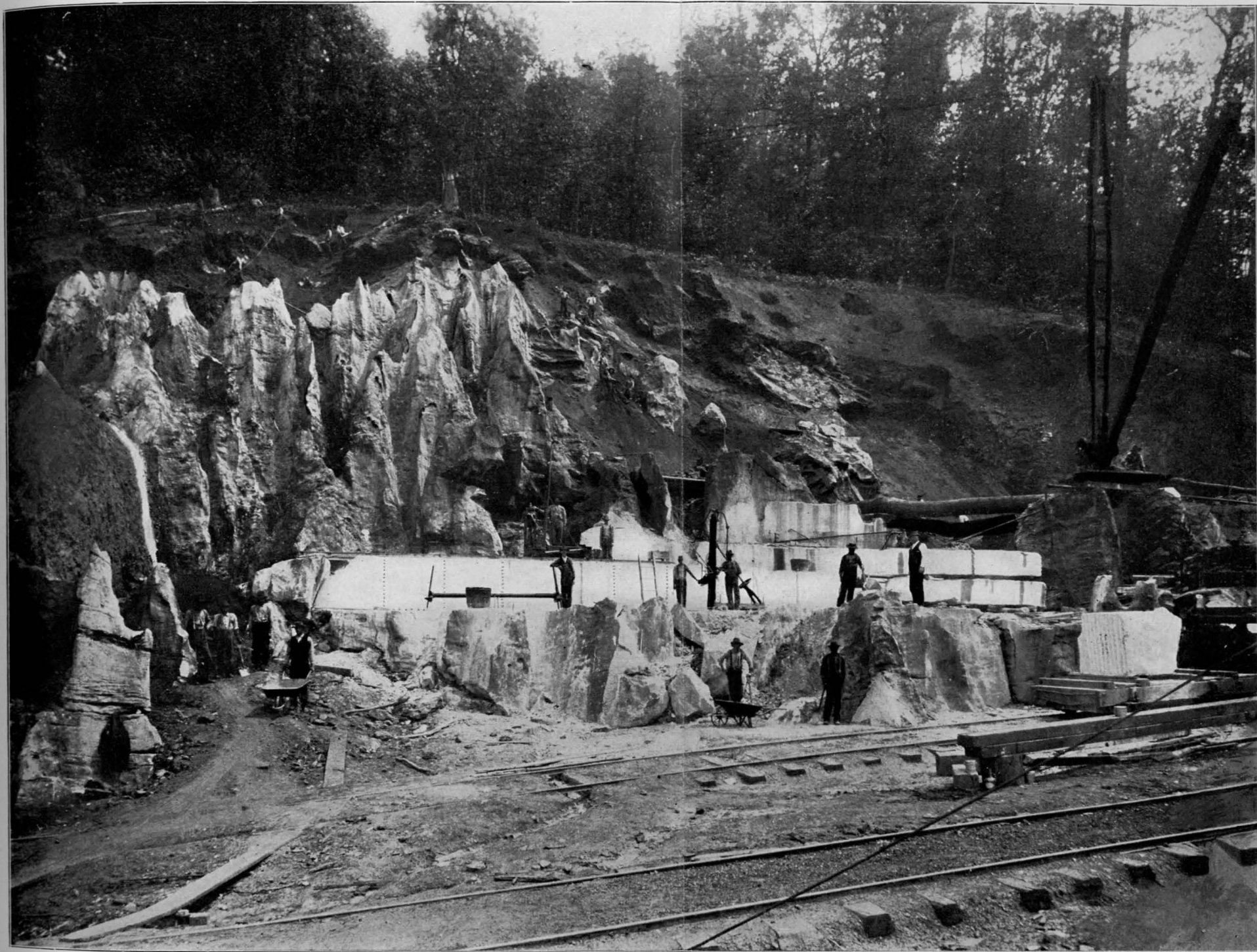
unusually fine texture. Mica is more or less prominent, as an inclusion, in this marble, and causes a cleavage-like structure, when abundant along certain lines. As the stone is neither exposed on the surface, nor used for building purposes, nothing is known of its mode of weathering.

MRS. DEAN'S PROPERTY

TWO MILES FURTHER DOWN CUTCANE CREEK, *on Mrs. Dean's property (lot 145, 8th district, 1st section)*, marble again occurs in the creek bottom. It may be seen here in a ditch, which has recently been cut just below the mill. It is said to have been discovered at other places along the creek, from four to five feet beneath the surface. It has been used to some extent in making lime. The texture and color of the marble are very similar to that found on lot 112; but there seems to be more mica in it, which, in places, renders the stone somewhat slaty in structure. Whether this mineral extends throughout the entire deposit, or is confined to certain layers, could not be determined from the extent of the exposure.

THE PARK PROPERTY

NEAR THE JUNCTION OF CUTCANE AND HEMPTOWN CREEKS, on what is known as the *Park property (lot 198, 8th district, 2nd section)*, considerable work has recently been done, in prospecting for marble. A quarry was opened here, and many cubic yards of stone were removed; but the work was finally abandoned, before any marble was put on the market. The texture of the stone, which occurs here, is well suited for ornamental purposes; but, on account of its unsound condition, it is a question whether or not it can be quarried with profit. White and light-gray, with an occasional band of black, are the prevailing colors. Mica and tremolite are the accessory minerals, the latter forming long masses of light-colored crystals, which are quite conspicuous on the weathered surface, and which make it difficult to polish the marble. Here, as elsewhere along the creek, the marble is found beneath an overburden of earth, from four to six feet in thickness, which appears to have been de-



OPENING A NEW QUARRY, SOUTHERN MARBLE QUARRIES, MARBLE HILL, PICKENS COUNTY, GEORGIA.

posited by the creek, as its lower layers are composed mainly of water-worn pebbles. At a number of places in the creek bottom near the quarry, it is said that marble has been discovered; but the quality of the stone at these places has never been thoroughly tested.

THE MINERAL BLUFF PROPERTY

ONE MILE EAST OF MINERAL BLUFF, marble is found in a somewhat hilly section, close to the road leading to Morganton. It occurs here, about five feet below the surface, at the foot of a hill, near a small stream, where, recently, it has been extensively prospected. Two excavations, only a few yards apart, each about twenty feet square and ten feet deep, have been cut into the marble, by means of channeling machines, and many large blocks have been taken out. Some of these still remain about the excavation; but most of them have been used for making lime. The marble from one of these openings has a very fine texture and a snow-white color; but mica occurs in some of the layers, in such abundance as to cause them to split quite easily along certain lines. In the other opening, the marble seems to be sounder and of a darker color; but it all contains both mica and hornblende. The white varieties of the stone, found here, resemble very closely, in texture and color, some of the Italian marbles, and would command a high price as an ornamental stone, if they were free from mica and other impurities. The extraneous minerals in marbles are frequently quite local, and disappear sometimes in a few feet, when a stratum is being penetrated. The soundness, also, may vary greatly at different depths. It is not possible, therefore, from the data at hand, to estimate, with any degree of certainty, the value of this deposit.

THE COX PROPERTY

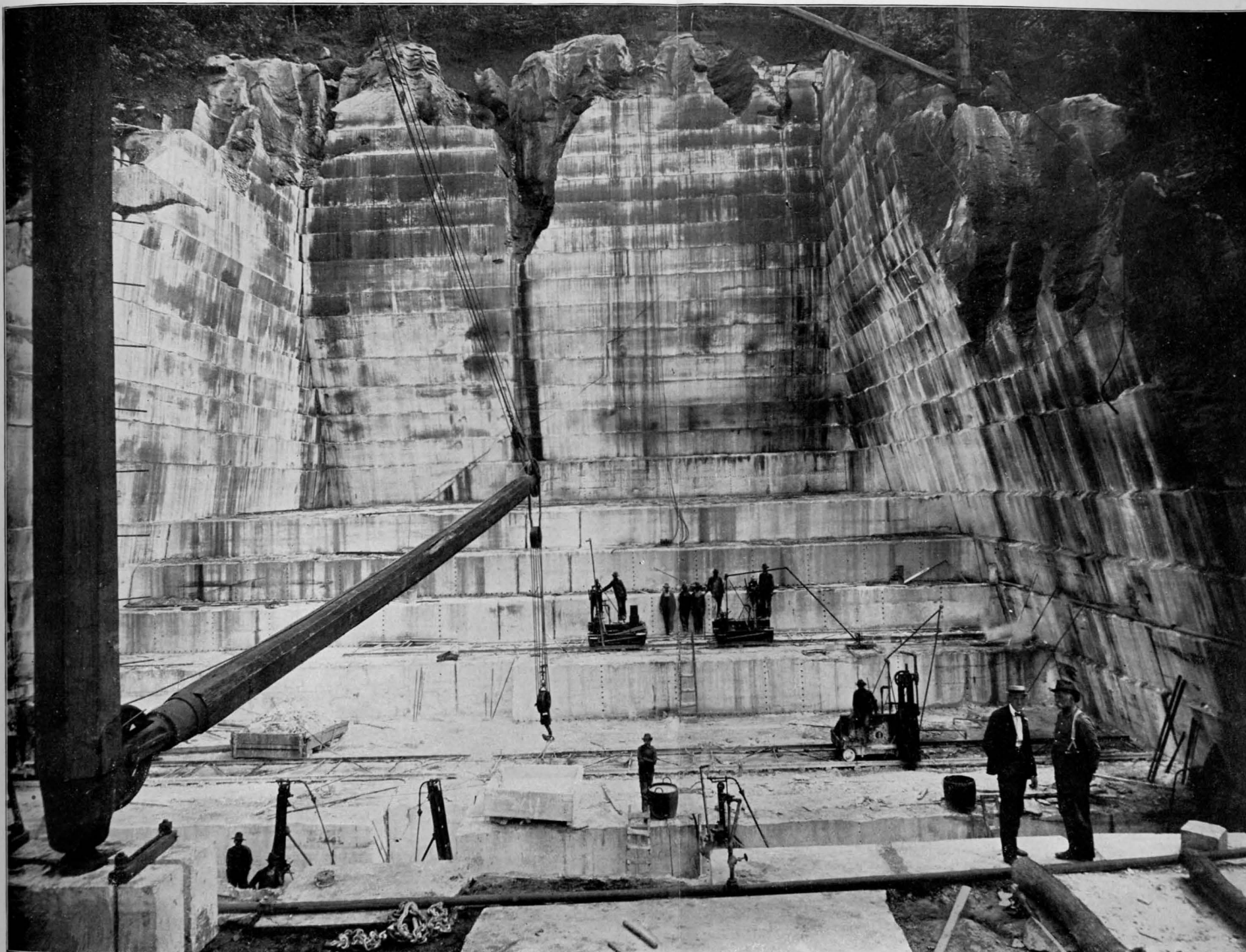
ON WEAVER CREEK, one mile east of Blue Ridge, *marble occurs on the Cox property (lots 239 and 240, 8th district, 2nd section)*. It outcrops, at only two or three places along the creek; but, by sinking pits, from four to five feet deep, in the creek bottom, it has been found to cover quite an area. Some test drill-holes were put down

here, a short time ago by parties holding an option on the property; but the result of the work seems not to have been made public, and we were unable to secure any data, as to these tests. The texture and color of the stone are like that found near Mineral Bluff; and it has the same impurities, with the addition of chalcopyrite in the form of small crystals. This exposure is probably the southern terminus of the eastern line of outcroppings, as it has not been discovered at any place south of this point.

THE RAPIER MILL CREEK PROPERTY

IN THE NEIGHBORHOOD OF SWEET GUM POST-OFFICE, the western line of marble outcroppings enters Fannin county from North Carolina. It first occurs near the State-line, in a narrow valley along Rapier Mill creek, *on lot 7, 8th district, 1st section*, where it has been found in a limited area, from six to twelve feet below the surface. Only two or three pits, exposing the marble, have been made here; but, just across the State-line near Culberson, N. C., an extensive quarry is in operation. A great amount of valuable stone has been taken from this quarry, and shipped to various eastern and western cities, where it always commands a high price, because of its superior qualities. The marble at both of these places is similar in color and texture. The crystalline grains, of which the stone is composed, are small and firmly united, forming a dense, compact marble, that admits of a brilliant polish. The common color is a dark-gray; but black and light-gray, streaked with black bands, occur. At the Culberson quarry is also found a flesh-colored marble, which has not been discovered on lot No. 7. Mica and other impurities are less abundant here, than at other places, hitherto examined in Fannin county; yet seams and cutters, though not numerous, cause considerable waste.

The rocks, associated with the marbles, along the western line of outcroppings, are like those along the eastern line; however, they are in a reversed order, the greenish hydro-mica slates lying to the east of the marbles, which overlie the gneisses and slates containing



THE NEW YORK QUARRY (QUARRY NO. 6), SOUTHERN MARBLE COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.

thin layers of metamorphic sandstone. The dip is generally to the southeast, at a high angle; and, at places, the strata are much folded and contorted.

THE ARP PROPERTY

AT ARP'S SPRING, one mile southwest of Sweet Gum post-office, on lot 42, 8th district, 1st section, marble appears a second time, in the Rapier Mill Creek valley. It occurs in a depression about the spring, underlying an area of about one-half of an acre. Before the adjacent hills were cleared, the marble was exposed on the surface; but now it is covered, from one to four feet deep, by sandy clays and gravel, washed in from the surrounding cultivated fields. A drill-hole was put down at this place a short time ago, to the depth of thirty feet, without passing through the stratum. The core taken out was said to have been generally sound, and free from impurities. In texture and color, the stone differs but little from that found on lot No. 7.

THE YOUNG STONE CREEK PROPERTY

ON YOUNG STONE CREEK, near Cole's crossing, marble similar to that found on the *Arp property*, is said to have been recently discovered.

THE DICKEY PROPERTY

While the workmen were engaged, a few years ago, in making the excavation for the bridge piers of the Marietta and North Georgia Railroad¹ at Toccoa river, marble was discovered near the water-level. Since then, a large pit, about thirty feet square and fifteen feet deep, has been dug, just below the bridge, in order to expose the marble. As the bottom of the pit lies below the surface of the river, and is usually covered with water, it was found to be impracticable, at the time of our visit, to make an examination of the stone *in situ*. It was learned, however, that the marble at the bottom of the opening was not a continuous mass; but it appeared to be in large boulders. On the opposite side of the river,

¹ Now the Atlanta, Knoxville & Northern Division of the Louisville & Nashville R. R.

the marble is said to have been found, underlying a considerable area, about the mouth of Young Stone creek; but no attempt has been made to develop it. The specimens of the stone, which were examined at the bridge, contained numerous cutters and seams, and were generally unsound. However, a very imperfect idea of a deposit, as a whole, can be obtained from a few boulders. All the marble found at this place is of a light color and a rather fine texture, and has comparatively few impurities.

THE FANNIN COUNTY POORHOUSE PROPERTY

ONE MILE SOUTHWEST OF BLUE RIDGE, on a farm belonging to the *County Poorhouse*, marble outcrops within a short distance of the Marietta and North Georgia Railroad.¹ There occur here, along a small stream, two exposures only a short distance apart, neither of which has been worked. The surfaces of the stone, which have been exposed to atmospheric agencies, are weathered uniformly, and appear to be generally sound. The marble is a dark-gray and of a coarse texture, with less mica, than is usually found in the marbles of Fannin county.

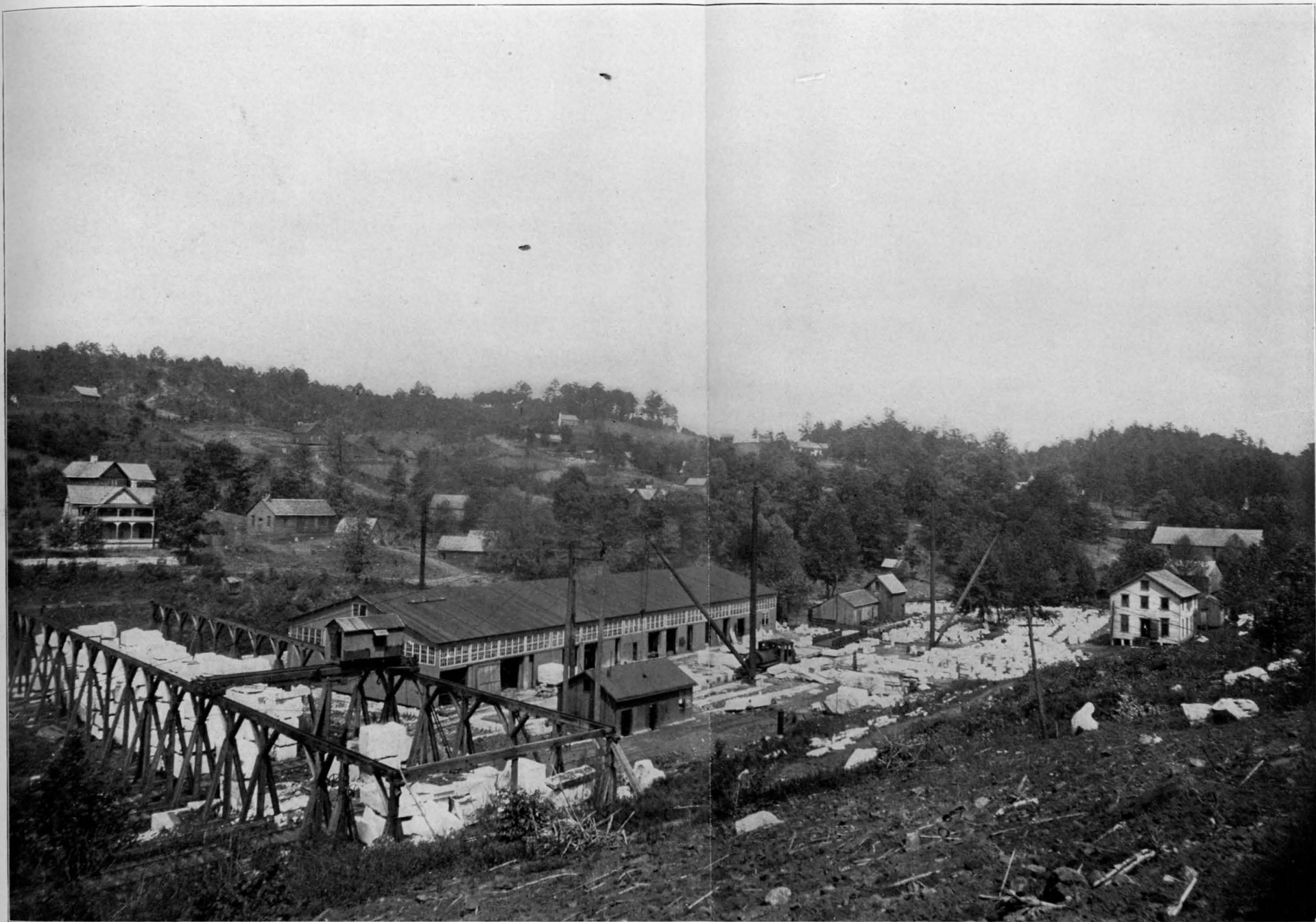
FACILITIES FOR TRANSPORTATION

By examining the accompanying general map of the marble belt, it will be seen, that the marbles of Fannin county are found along the line of the Marietta and North Georgia Railroad,¹ which follows for twelve miles the western line of outcroppings, at no place leaving them, more than a few hundred yards. The eastern line of outcroppings, though not so favorably located, could be easily reached by running a branch road from Mineral Bluff.

WATER-POWER

The map also shows that all the marble, thus far located, with only one exception, is near creeks, whose sources are well up in the adjacent hills and mountains. These streams, though usually small, are

¹ Now the Atlanta, Knoxville & Northern Division of the Louisville & Nashville R. R.



GENERAL VIEW OF THE SOUTHERN MARBLE WORKS, MARBLE HILL, PICKENS COUNTY, GEORGIA.

quite rapid, and have a great deal of fall, which can be utilized in furnishing water-power to operate mills or other machinery.

ONLY ONE STRATUM OF MARBLE

The relative positions of the associated rocks, along each line of outcropping, show that all the marble belongs to the same stratum. This stratum, once horizontal, but now dipping at a high angle to the southeast along both lines of outcropping, has been brought to its present position by the folding of the strata. Erosion has decapitated these folds, and left the upturned edges of the marble extending across the country, in two continuous lines. Owing to the great depth of residual clays, and, probably, to local faults in this region, the marble is found only in certain favorable locations, usually along streams, where it has been exposed to view by the action of running water.

CHAPTER V

THE MARBLES OF GILMER COUNTY

Gilmer county, though containing extensive beds of marble, has not yet produced stone of any consequence, either for building or for ornamental purposes. At a few places, the stone has been used to a limited extent, for making lime; but at present, no quarries of any kind are in operation. The prospecting, carried on in the county, has been confined to a few small pits and drill-holes, which are not sufficiently extensive, to give any very definite knowledge of the deposit.

THE LACEY PROPERTY

ON ROCK CREEK, one mile southwest of Cherry Log post-office, marble occurs on *F. L. Lacey's property* (lot 182, 8th district, 2nd section). It outcrops in the bed of the creek, and is found a few feet below the surface in the adjacent bottoms. The area, over which the marble has been discovered, is less than an acre in extent, being confined to the narrow valley along the creek. One or two pits have been sunk on this property; but no attempt has been made, by boring or otherwise, to ascertain the thickness or the general soundness of the stone. A few drill-holes, put down here at the proper place, would probably reveal the true value of the deposit, without any great outlay of money. Wherever it was practicable to make an examination of the stone, it was found to be of the usual light or dark-gray color, and of fine texture. The weathered surfaces show but little mica or other impurities. The associated rocks are very similar to those found in Fannin county, though much more folded and contorted. If this deposit should prove to be valuable, after being thoroughly prospected, the water-power of Rock creek and the closeness of the railroad are advantages, that would materially aid in the cheap production of marble at this place.

THE WHITAKER PROPERTY

NEAR WHITE PATH, marble is found on *lots 272 and 273, 10th district, 2nd section, owned by P. B. Whitaker.* It outcrops along White Path creek, below the railroad trestle, and lies just beneath the surface, on both sides of the railroad, underlying an area, probably of three acres. Two or three drill-holes, from ten to thirty feet in depth, together with a ditch, exposing the stone to the distance of forty feet, is all the work that has been done here towards developing the property. The cores, taken from the borings, are said to have been generally sound throughout their entire length; however, the stone, which was examined in the creek, was somewhat laminated, due to the considerable quantity of mica it contained. The color and texture of the marble west of the railroad is like that found on the Lacey property, while some of the layers on the east side are quite black; and, on account of their fine grain and banded structure, are likely to be taken for slate. The black variety contains small crystals of pyrite (an iron sulphide). Nevertheless, it could probably be used for tiling and other indoor work.

THE HOLT PROPERTY

ON THE HOLT FARM, which joins the Whitaker property, marble outcrops at various places, about the junction of Big and Little Turniptown creeks. Here, the narrow valleys along the creeks become suddenly expanded into a wide fertile bottom, nearly surrounded by high hills. Near the center of the bottom, the marble outcrops in the creek at several places, and is said to be found underlying a number of acres in the immediate vicinity. A small amount of stone has been quarried here to make lime, and at one place a corner-stone was secured for the school building at Ellijay; but, otherwise, the deposit is undeveloped.

The general appearance of the stone is similar to the lighter varieties, found on the adjoining property, though a pale-blue variety also occurs. The crystalline grains are quite small, being difficult to distinguish with the unaided eye. The surfaces of the outcrop-

ping at some places are unevenly weathered, and show a somewhat laminated structure; while at other places they weather evenly, and appear to be comparatively free from impurities. The area, over which the marble has been located at this place, indicates a rather extensive deposit; and it, very likely, contains much valuable stone. This, however, cannot be positively ascertained, until the property is thoroughly prospected.

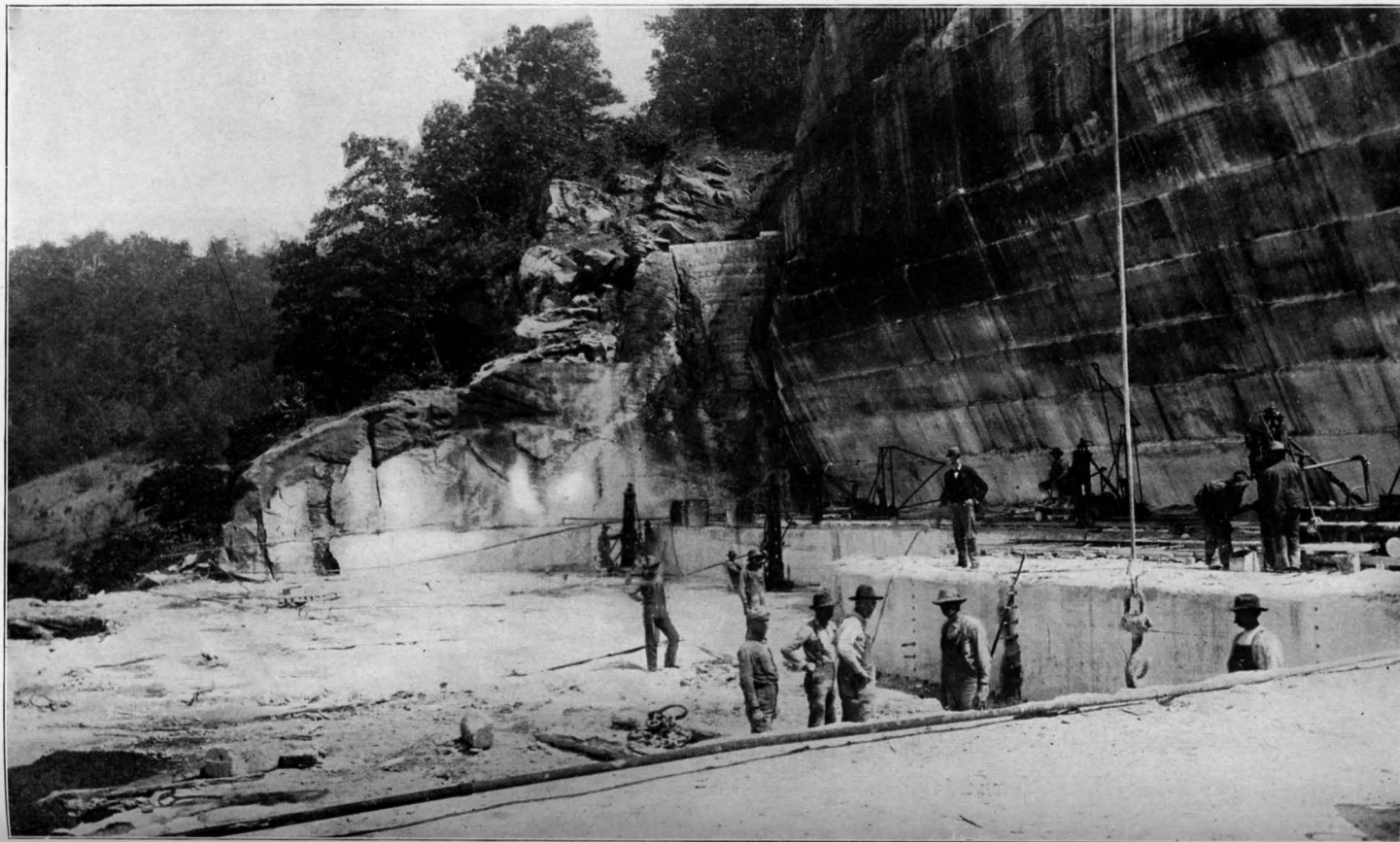
Big Turniptown creek is a stream of considerable size, and would furnish quite a water-power, that could easily be utilized, in operating quarries on the Holt property.

THE RAY PROPERTY

FIVE MILES SOUTH OF ELLIJAY, near the head-waters of Tolona creek, marble occurs on *John Ray's property (lot 225, 10th district, 2nd section)*. This is the northern terminus of a series of outcroppings, which extend along this creek, with only one or two interruptions, for about six miles. The marble appears at this place, at the foot of a hill and in the branch near by. At no place, has any work been done to test its extent or quality. The specimens collected are fine-grained, and of a light-gray or white color.

LOT 260, 10TH DISTRICT

A FEW HUNDRED YARDS SOUTH of this exposure (*on lot 260, 10th district, 2nd section*), there is a more extensive outcropping, which forms, near the creek, a bluff about twelve feet in height. A small quarry was opened, here, some years ago, to secure stone for making lime; but it has since been abandoned. Much of the marble, outcropping here, seems to be quite solid, free from mica, and weathered evenly on exposed surfaces. It is similar, both in color and texture, to the stone found on lot 225, described above. Just west of the marble at this place, is quite a deposit of iron ore, which is frequently found associated with the marbles of North Georgia. It reaches its greatest development on the Holt property, where it appears quite abundant on Iron Knob.



ONE OF THE KENNESAW QUARRIES, GEORGIA MARBLE COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.

LOTS 142 AND 143, 12TH DISTRICT

ONE AND A HALF MILES SOUTH OF TOLONA POST-OFFICE, on *lots 142 and 143, 12th district, 2nd section*, marble outcrops along the eastern side of the valley, forming a line of cliffs as far south as Price's creek. The marble, here, is mostly light-colored and fine-grained; but there also occurs a dark or motley-colored variety, with coarse grains. Both of these varieties contain more or less mica; especially is this true of the fine-grained variety. Quartz is sometimes seen to project from the weathered surfaces, in the form either of veins or of nodules. The marble, that has been exposed in the cliffs for a long time, commonly shows a comparatively even weathering. Near the railroad trestle, on lot 142, a drill-hole was put down, about two years ago, by a party holding an option on the property, to the depth of eighty feet, without passing through the marble. The result of this work was kept a secret, and, as a consequence, no reliable information could be obtained, with reference to the character of the stone penetrated. The value of the marble in this vicinity depends largely on its soundness, and any light on this important question, that is likely to be obtained from deep boring, is very desirable, and should always be carefully noted.

THE GARTRELL PROPERTY

HENRY GARTRELL'S PROPERTY, generally known as *Marble Bluff*, joins lot 142, above mentioned, and lies along the east side of Tolona valley, just below the mouth of Price's creek. The marble forms near the creek a bluff, eighty feet in height, almost perpendicular, with the Marietta and North Georgia Railroad¹ running at its base.

This is one of the most extensive natural exposures of marble in the State, and has always attracted attention; but, so far, it is practically undeveloped. The marble attains a thickness, at this place, of about one hundred and seventy-five feet, and varies greatly, both in texture and color. There are three principal colors, viz:—pink,

¹ Now the Atlanta, Knoxville & Northern Division of the Louisville & Nashville R. R.

white and dark-gray. The pink is found near the upper part of the stratum, where it forms thin layers, which appear to extend only a short distance along the edge of the outcropping. The white is the most abundant; it, also, is found in the upper part of the stratum, while the darker colored, or gray, lies at the base. The last named variety has rather a coarse texture, being made up of crystalline grains frequently an eighth of an inch in diameter, yet so firmly united as to form a very solid marble. The white and the pink have a very fine texture; and, when free from mica, they admit of a very high polish. These fine-grained marbles, when they contain much mica, weather unevenly; but, where this impurity is absent, the weathered surface is found to be quite smooth, and the stone, well suited for ornamental purposes. The darker varieties have but few impurities, and, consequently, weather evenly. The lower layers of the stratum seem to be generally sound, and free from seams, while the upper layers are more or less laminated, and, at places, show evidence of shearing. Some chalcopyrite and quartz occur, as inclusions in the marble; but they are not in sufficient quantities to be injurious. A company began work here in the spring of 1893, with a view of opening a quarry; but, at the time of our visit, the work was temporarily suspended. No work had previously been done here, except the digging of one or two pits in the creek bottom, to ascertain the extent of the marble. This property is the most favorably located of any in Gilmer county, for the cheap production of marble. Besides the railroad and suitable grounds for the location of mills and marble-yards, Price's creek, a mountain stream of considerable volume of water, can be easily controlled, so as to furnish the necessary power to run all the machinery. For the first two miles, above where it enters Tolona valley, it has a fall of nearly one hundred and fifty feet, and the narrow valley or gorge, through which it flows, becomes so contracted at places, that retaining dams can be constructed, with but little expense.

CHAPTER VI

THE MARBLES OF PICKENS COUNTY

Pickens county is, at present, really the only marble-producing county in the State. The value of the deposits, here, has long been known; but only of recent years have they been worked on an extensive scale. A number of companies are now operating in the vicinity of Tate, each of which makes annually large shipments of stone, for both building and ornamental purposes.

The marbles enter this county from Gilmer, on *lot 140, 5th district, 2nd section*, which joins the Gartrell property. The bluffs, here, are almost as high and precipitous as those on the adjoining lot; and the only apparent difference in the character of the stone is the absence of the flesh-colored layers. A few hundred yards further down the creek, on *lot 139, 5th district, 2nd section*, a considerable quantity of marble has been quarried, for making lime. The kiln is situated on the east side of the railroad, where a siding has been put in, from the main track. The capacity of the kiln is about one thousand barrels per month, selling at seventy-five cents per barrel. It is used for both mechanical and agricultural purposes. The lower layers of the stone on this lot appear to be quite sound, and weather evenly. On the opposite side of the railroad from the lime-kiln, a drill-hole has been put down in the marble thirty feet. The core, taken from the boring, is said to have been quite solid, throughout its entire length.

THE GODFREY PROPERTY

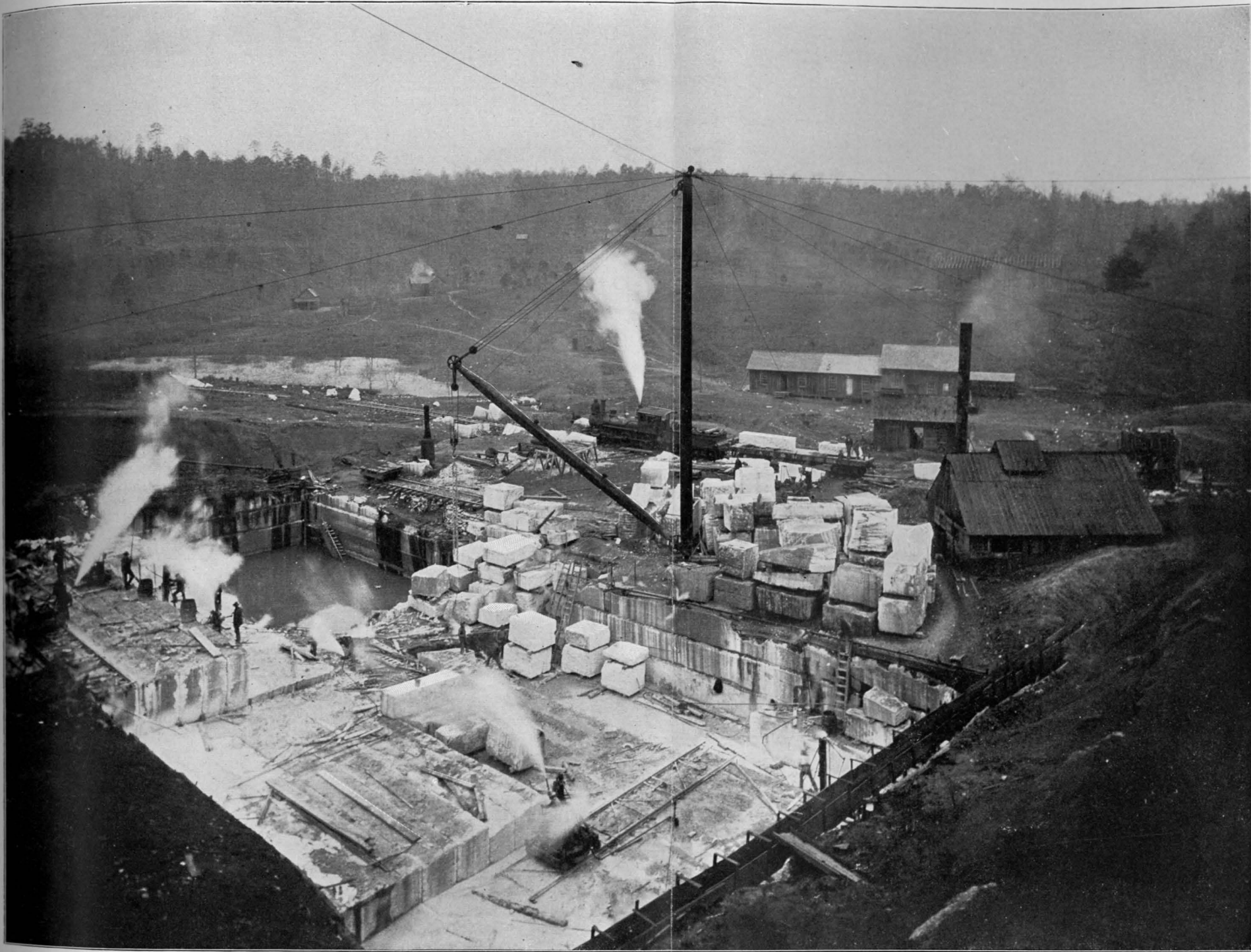
ON THE GODFREY PROPERTY (*lot 151, 5th district, 2nd section*), near the mouth of Fisher's creek, is an extensive exposure of marble, that seems to be the southern terminus of the deposit in Tolona valley.

Between this property and the lime-kiln, lies lot 138, 5th district, 2nd section, through which the marble continues, forming high bluffs, which overhang the creek; but, on the Godfrey property, it appears, as large exposed surfaces on the gradually sloping, wooded hillside. It also outcrops in a number of places in the cultivated fields. A small quarry, long since abandoned, was opened here, more than forty years ago, in order to secure marble for tombstones. These stones are now to be found throughout the county, in various graveyards, little affected by the atmospheric agencies, after an exposure of thirty or forty years. Refuse blocks and spalls lying about the quarry, and the old marble chimney at the Godfrey residence, well illustrate the durability of this stone. Its color is usually white or dark-gray. The texture varies from coarse to fine-grained; the former, which predominates, is sounder than the latter, and contains scarcely any mica.

ABOUT HALF A MILE SOUTH OF THIS EXPOSURE, and running parallel with it, is another line of marble outcroppings, which belong to an entirely different stratum. It is an impure dark-colored stone, with a somewhat slaty cleavage, forming, on the hill near Fisher's creek, a bluff thirty or forty feet in height. What appears to be the same stratum outcrops in the road opposite Tolona school-house, and is found near the State-line in Fannin county; but only in the vicinity of Ball Ground and Canton, in Cherokee county, is it likely to be of any economic value.

THE EAGER PROPERTY

FOUR MILES NORTHEAST OF TALKING ROCK STATION, on the head-waters of Fisher's creek, several hundred dollars were spent, a few years ago, in prospecting for marble on the *Eager property*; but the work was finally abandoned without opening any quarry. Three excavations were made here—two on the hillside, and one near the head of a narrow hollow close by. The marble appears as a natural exposure, at several places on the hill; but it lies beneath the surface in the hollow. The prospecting, carried on here, was directed mainly to stripping the earth from the marble, with a view to de-



THE AMICALOLA QUARRIES, ATLANTA MARBLE COMPANY, PICKENS COUNTY, GEORGIA, WITH MARBLE HILL IN THE DISTANCE.

termining the extent and character of the deposit. Some of the surfaces, thus exposed, show a very peculiar mode of weathering. At one place, a large cavity, which resembles very closely a pot-hole, may be seen. It is about eight feet in diameter and fifteen feet deep. This irregular mode of weathering is due, either to the unsound condition of the stone or to the impurities which it contains, or to both of these causes combined. The crystalline grains, making up the stone, are sometimes an eighth of an inch in diameter; but they are usually much smaller. The coarse-grained variety is generally found in the lower part of the stratum, while the fine-grained and lighter-colored variety occurs above.

This property is the most unfavorably located, with reference to transportation, of any heretofore examined; however, a branch road not over five miles in length could be easily constructed up Fisher's creek, connecting with the main line of the Marietta and North Georgia Railroad.¹

THE PERSEVERANCE QUARRIES

TWO MILES EAST OF JASPER, on Longswamp creek, marble occurs on *J. P. Harrison's property*, on which are the Perseverance Marble Quarries. It forms here, along the east side of the creek, an almost continuous series of bluffs, forty or fifty feet in height and nearly a mile in length. Four quarries have been opened, one of which was quite extensively worked a few years ago, and produced much valuable marble. But it is at present abandoned, and the greater part of the machinery has been removed to the Piedmont works, where better facilities for transportation are at hand.

The stone found here is mostly of a snow-white color, having a fine texture; but, unfortunately, seams are of such frequent occurrence, as to make it difficult to quarry blocks of large size. The manner, in which the marble weathers, is well illustrated by a number of tombstones from this quarry, which have been exposed for several years in the graveyard near Jasper. Some of these stones are uniformly weathered, while others, containing mica, have rough

¹ Now the Atlanta, Knoxville & Northern Division of the Louisville & Nashville R. R.

and irregular surfaces. The fine texture and brilliant polish, which this stone admits of, makes it very valuable for ornamental purposes. Two diamond-drill holes, one 111 feet and the other 130 feet deep, have been put down on this property, neither of them passing through the stratum of marble. The parts of the cores from these holes, which were examined, showed the character of the stone penetrated, to be similar to that exposed in the natural outcroppings.

The marble here dips to the southwest at an angle of about 30°, and attains a thickness, as demonstrated by the boring, of nearly two hundred feet. Longswamp creek divides on this property into two streams of nearly the same size. Each branch is quite rapid, and has a great deal of fall, that could be easily utilized, by constructing dams at the narrow points in the valley. A water-power, sufficient to operate an extensive quarrying-plant, could be secured here, with a comparatively small outlay of money.

SOUTH OF THE HARRISON PROPERTY, the marble continues along the east side of the creek for about two miles, being seen last near Tate's mill. At some places, it appears as bluffs, well up on the hill-side; but, in others, it is found underlying the creek bottom. Some prospecting has been done at two places along the bluff, where the color and texture of the stone resemble very closely that found further up the creek.

THE DISHEROOM PROPERTY

ONE MILE EAST OF MARBLE HILL POST-OFFICE, on *the Disherroom property*, marble occurs on both sides of the east branch of Longswamp creek, where it forms two different lines of outcroppings. The outcropping lying farthest to the north continues along the creek for only about half a mile, where it seems to be abruptly terminated by a fault, while the other forms a continuous series of outcroppings more than five miles in length. It first runs almost due east and west for about three miles; but, at the juncture of the east and west branches of Longswamp creek, it turns rather abruptly to the south, and follows the east side of the main stream for nearly two and a half miles, where it finally disappears beneath the overly-



INTERIOR OF WORK-SHOP OF THE ATLANTA MARBLE COMPANY, BALL GROUND, GEORGIA.

ing schist. There are only two natural exposures of the marble on the Disheroom property, and these are so limited in extent, as to give but a very imperfect idea of the general character of the stone.

The specimens secured from the southern line of outcroppings are of a white or light-gray color, and contain a good deal of chalcopryrite. The texture is much finer, than that of the white variety of marble found on the small line of outcroppings elsewhere in this vicinity. Specimens from the opposite side of the creek, and belonging to a different line of exposures, are of a flesh color, more or less banded with black and green. On the adjoining lot, owned by William Pool, the marble appears to be much more extensive. It is said to be found here, at a number of places in the creek bottom. It outcrops in the spring, near the house, and is exposed south of the road in a small stream, where it has been prospected. The stone is very similar to that found at the Southern marble quarries, situated on the same outcroppings, a few hundred yards farther down the creek.

THE SOUTHERN MARBLE COMPANY

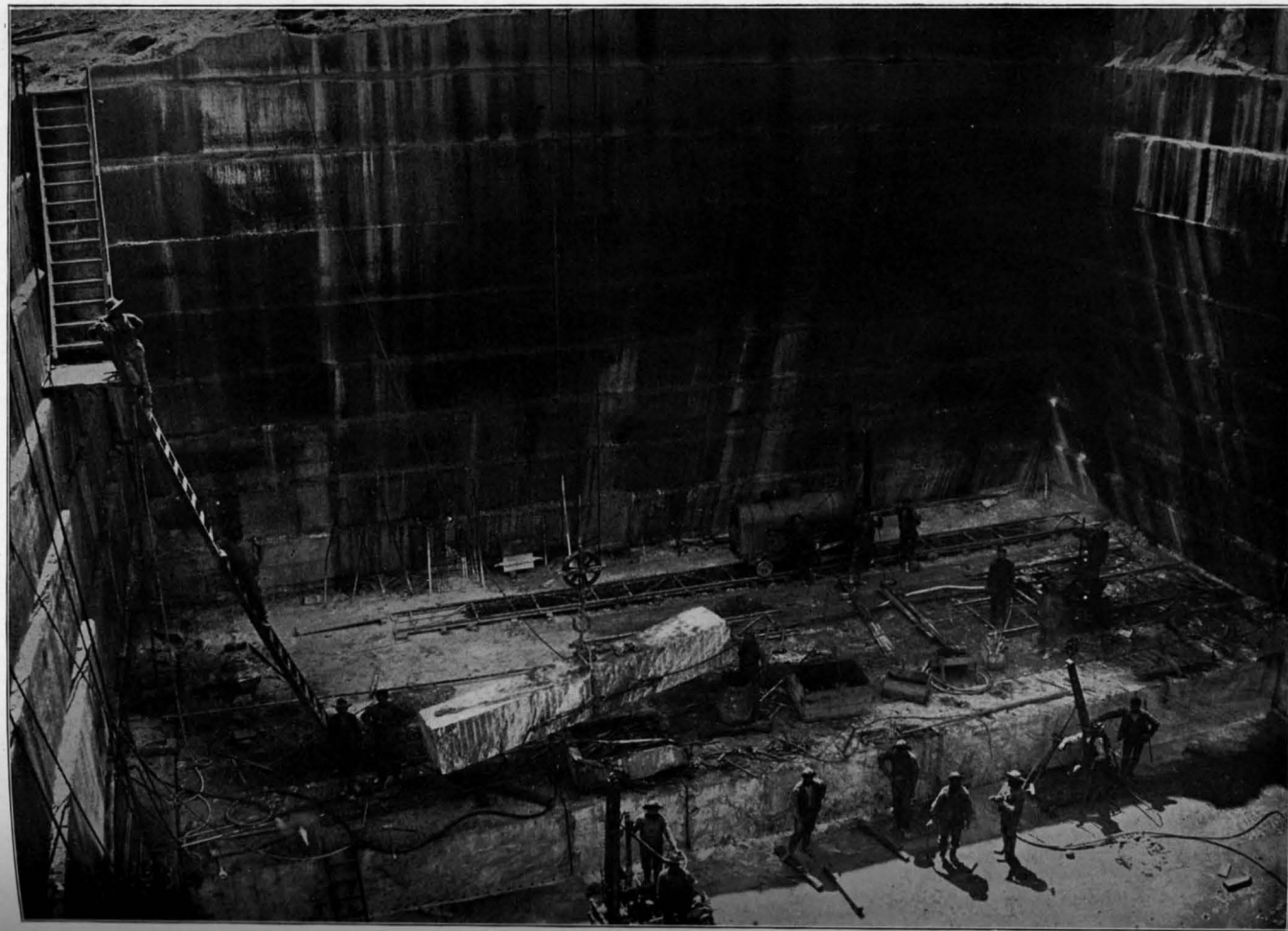
The Southern Marble Company's quarries are located along the east side of a ridge known as Marble Hill, on the east fork of Longswamp creek, in the immediate vicinity of Marble Hill post-office, four miles east of Tate station, at which point a branch railroad connects the quarries with the Louisville & Nashville Railroad. The valley of the east fork of Longswamp creek, in the neighborhood of the Southern Marble quarries, becomes quite narrow, and the adjacent hills are high and precipitous, especially those along the south side of the creek, where the quarries are situated.

The Southern Marble Company has opened six quarries on this property, which are here designated, for convenience of description, as quarries Nos. 1, 2, 3, 4, 5 and 6. Quarry No. 1, known also as the Mountain quarry, was the first quarry opened on the property, and is the one, from which the marble for the stair-cases and tiling in the State Capitol was obtained. This quarry, which has not been worked for some years, is located on the side of the hill immediately

above the mill. It is 80 by 80 feet at the surface and 30 feet deep. The excavation is located near the contact of the marble and the overlying formation. Just above the marble at this point and in immediate contact with it, is an intrusive mass of hornblende rock (amphibolite). The change which has noticeably taken place in the marbles at this point, apparently due chiefly to contact metamorphism, is the alteration of the dark marble into white marble, and an increase, at the same time, of mica and the other accessory minerals, except graphite, which mineral seems to have largely disappeared in the process of metamorphism. Other quarries in the neighborhood show marble similarly affected by contact metamorphism. The fountain head of the intrusive sheets appears to be a high hill a short distance to the northeast. This hill appears to be made up almost entirely of the hornblende rock.

The stone exposed in Quarry No. 1 is very free from fissures and seams, and as a consequence, stones of almost any dimensions can be quarried. The surface of the stone, which has been exposed in natural outcrop for long periods of time, generally shows uniform weathering. The crystalline granules making up the marbles are usually large and semi-transparent. Some of the granules are fully one-fourth of an inch in diameter. The stone, when polished, presents a somewhat mottled appearance, rather than a uniform white color. There are a number of accessory minerals present; of these, the most abundant and injurious are muscovite or white mica, and tremolite. The former mineral appears to be best developed along lines, which probably correspond to the original bedding of the stone; while the latter is more irregularly distributed. The tremolite is easily recognized by the blade-like form of its crystals, and by its splintery fracture. Both minerals are harder than marble; and, as a consequence, they interfere with the polishing of the stone.

Quarry No. 2, also known as the Hall Quarry, is only a few hundred yards northwest of Quarry No. 1. This quarry, which has furnished a large amount of stone, has recently been filled up by waste material from Quarry No. 3. The latter quarry, which is 50 by 60 feet at the surface, and about 30 feet deep, has also been



ONE OF THE CREOLE QUARRIES OF THE GEORGIA MARBLE COMPANY, NEAR TATE, PICKENS COUNTY, GEORGIA, SHOWING THE HOISTING OF A LARGE BLOCK OF MARBLE BY USE OF THE DERRICK.

abandoned. The stone in this quarry is said to have been too dark for the trade. However, a test-hole put down showed white marble at a greater depth. Quarry No. 4, often called the Spring Quarry, on account of a spring of water flowing into it, is only a few hundred feet northwest of Quarry No. 3. This quarry is 100 by 80 feet at the surface and about 60 feet deep. It has furnished a large amount of white marble. Within a few rods of Quarry No. 4, is Quarry No. 5, known also as the Rhode Island Quarry. It is now temporarily abandoned on account of a land-slide. It is 100 by 80 feet at the surface and about 60 feet deep. Still further to the south, and occupying about the same elevation as the other quarries, is Quarry No. 6, or the New York Quarry. This quarry, which has been opened only for a short time, is 100 by 160 feet at the surface and about 100 feet deep on the upper side. The only quarries above described, which were being worked at the time of the writer's recent visit, were Quarries Nos. 4 and 6. All these quarries are connected, by a branch railroad, with the mill, which is located in the valley only a short distance from the quarries. Originally, stone, when loaded upon the cars, was carried by gravity directly to the mill in the valley below; but, at present, an engine, which handles the marble in the yard, does this work.

The mill of the Southern Marble Company is quite complete. It is supplied with 9 gang-saws, 2 cut-off saws, 1 band wire-saw, 1 80-horsepower boiler and engine, used only during extremely low water, an electric-light plant, 2 13-foot rubbing-beds, and air compressors. At the west end of the mill, is located a steam-traveler, 250 by 40 feet, used for storing the large marble blocks, as they come from the mill. The traveler, together with a large derrick used for handling the stone about the mill, is operated by a 50-horsepower boiler. The water-power operating the mill itself is water, which is collected from a number of small streams in the mountain, about two miles away, and is conducted through ditches and pipes to the mill. Here, under a pressure of 210 feet, the water is conveyed; through a one and a half inch nozzle, onto a Pelton wheel, which generates 75 horsepower. During the extremely dry season,

the water becomes insufficient to operate the mill, in which case the 80-horsepower boiler and engine, above referred to, are put into use. The writer was informed by Mr. W. S. Lincoln, the Superintendent of the marble works, that the company contemplates soon to utilize further their water-power, and to increase the capacity of this mill by adding 12 gangs of saws.

The quarry equipment consists of 8 channelers, 7 gadders, 4 derricks, 1 100-horsepower boiler, 1 50-horsepower boiler and 3 hoists. The company also owns 1 locomotive, 2 miles of Standard-gauge railroad, an office building, and 12 cottages for employees. The output of the quarries, at present, employing about 100 men, varies from 18,000 to 20,000 cubic feet per month.

The price-list of the marble, furnished by the Southern Marble Company, is as follows:—

Rough Marble in Blocks

	Per Cubic Foot
Southern No. 1	\$2.00
Southern No. 2	\$1.00 to 1.50
Southern No. 3 .....	.50 to 1.00

Slabs

For Full Size of Blocks per Superficial Foot

Southern No. 1, $\frac{7}{8}$ inch to 2 inches in thickness.....	\$.35 to \$.60
Southern No. 2, $\frac{7}{8}$ inch to 2 inches in thickness.....	.30 to .50
Southern No. 3, $\frac{7}{8}$ inch to 2 inches in thickness.....	.25 to .40

Monumental Stock

	Per Cubic Foot
Southern No. 1 } Southern No. 2 } Southern No. 3 }	.....from \$1.50 to \$4.00

Miscellaneous

No. 3 base strips and bottom bases, per cubic foot.....	\$1.50
Markers, 12 to 14 inches long by 3 inches thick.....	.35
Markers, 12 to 14 inches long by 4 inches thick.....	.50

Markers, 16 to 18 inches long by 3 inches thick.....	.75
Markers, 16 to 18 inches long by 4 inches thick.....	1.00
Foot stones, 5 to 8 inches by 2 inches thick.....	.20
Foot stones, same size, sawed heads.....	.22
Foot stones, same size, sawed heads and sand-rubbed.....	.25
Foot stones, same size, sand-rubbed.....	.25
Foot stones, same size, sawed heads, sand-rubbed and boxed..	.28
Dimension dies, extra per cubic foot.....	.50

THE PIEDMONT MARBLE QUARRIES

The Piedmont marble quarries, now owned by the Marble Hill Quarry Company, of Marble Hill, Georgia, are located only a few hundred feet west of the Kennesaw marble quarries, at the north base of Marble Hill. These quarries are designated as Quarries No. 1, No. 2 and No. 3. Quarry No. 1 is 50 by 50 feet at the surface and 50 feet deep; No. 2 is 50 by 100 feet at the surface and 50 feet deep; and No. 3 is 90 by 120 feet at the surface and 15 feet deep. None of these quarries is at present being operated. The marble of the Piedmont quarries is quite similar to the marble obtained from the nearby Kennesaw quarries; though the stone is not so sound. The mill located near the quarries, now leased and operated by the Blue Ridge Marble Company, is large and well equipped. It is supplied with 11 gangs of saws, 2 cut-off saws, 2 12-foot rubbing-beds, 2 double-headed planers, 3 lathes for turning marble, 2 dynamos, 1 high speed engine, 2 75-horsepower boilers. The Marble Hill Quarry Company also owns 1 locomotive, an electric traveler and a large cutting-shed, 30 by 385 feet.

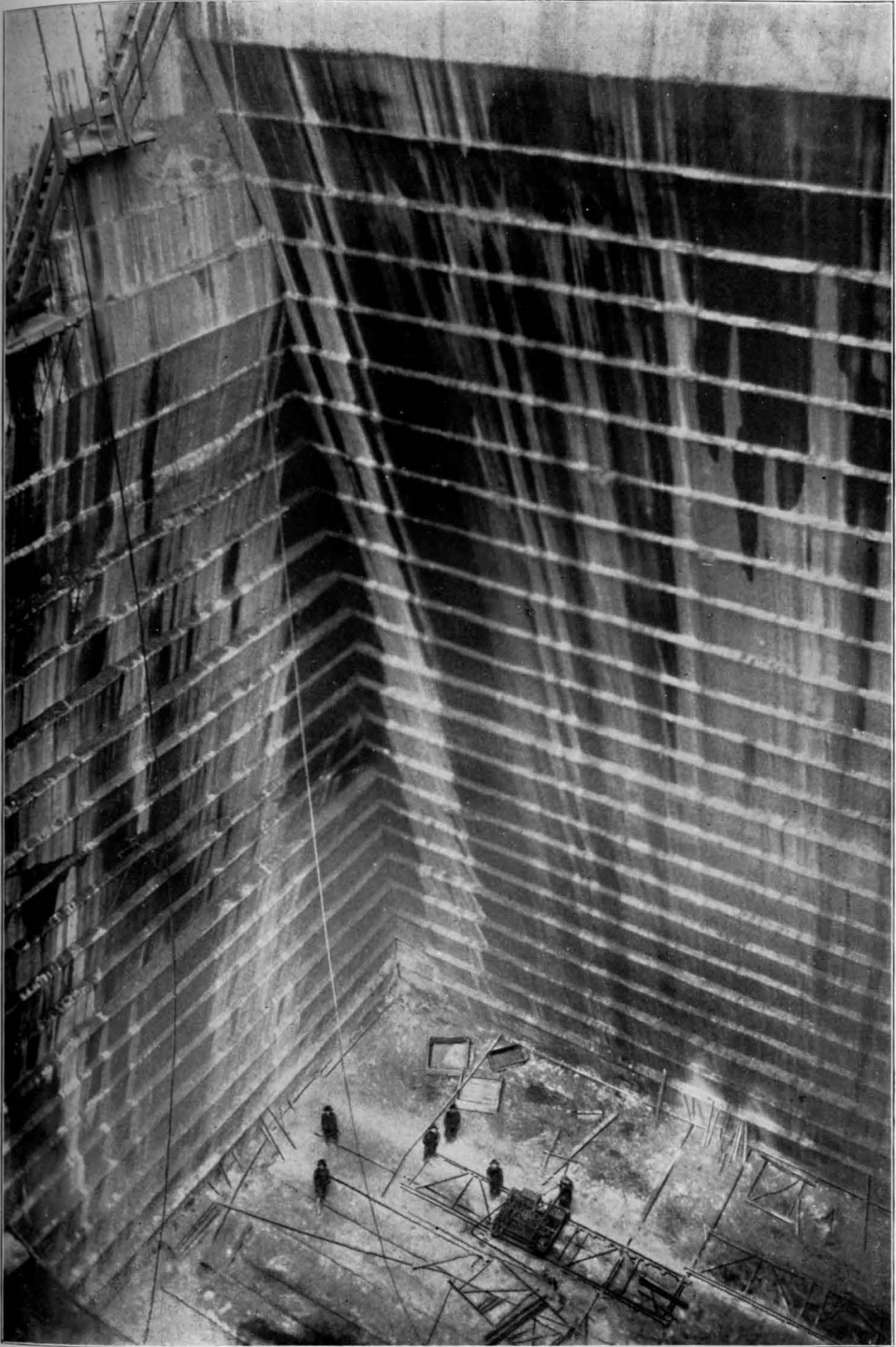
THE AMICALOLA MARBLE QUARRIES

These quarries, at present operated by the Atlanta Marble Company, are located about one mile southeast of the Southern Marble Company's quarries, in the valley south of Marble Hill. The property, on which the quarries are situated, was formerly known as the Herndon property. The marble occurs here in a narrow valley,

drained by a small tributary of the east fork of Longswamp creek. Formerly, the marble showed at only one or two places along the stream; but, by sinking pits from two to six feet in depth, it has been found to extend along the valley for 300 or 400 yards. The first effort, made to open up a quarry on the Herndon property, was about the year 1892, when two or three large blocks of marble were taken out. No further work was done until 1897, when the Amicalola Marble Company purchased the property and opened up the first quarry. This quarry, which is 60 by 100 feet at the surface, was worked to the depth of 75 feet and furnished an unusually large amount of sound high grade stone. A second quarry, which is now being worked, has been opened up immediately adjoining the first quarry. This quarry is 125 by 148 feet and about 25 feet deep, and is at present furnishing some excellent white marble. The marble from the Amicalola quarries is very similar to the marble obtained from the Southern Marble Company's quarry. The stone, however, is usually freer from fissures, and of a more uniform white color. The chief accessory mineral is tremolite, which occurs as small irregular blades and masses unevenly distributed throughout the stone. Mica, graphite and hornblende also occur; but these minerals are generally not so abundant as in the marbles of some of the other quarries in the district. Some idea may be had of the general soundness of the Amicalola marble, by the following list of large pieces of stone furnished for the Minnesota State Capitol, which was constructed entirely of this marble:—

- 42 columns, 21 feet, 6 inches by 3 feet, 5 inches by 3 feet.
- 12 ceiling beams, 17 feet, 0 inches by 4 feet, 6 inches by 3 feet.
- 12 beams, 15 feet, 9 inches by 4 feet, 6 inches by 3 feet.
- 4 panels, 4 feet, 9 inches by 6 feet, 2 inches by 2 feet.
- 6 panels, 15 feet, 9 inches by 4 feet, 8 inches by 2 feet.
- 12 panels, 9 feet, 0 inches by 8 feet, 2 inches by 2 feet.

The Amicalola marble quarries, now operated under a lease by the Atlanta Marble Company, are connected by a branch standard-gauge railroad, 9 miles long, with the Louisville & Nashville R. R.



CREOLE QUARRY NO. 1, GEORGIA MARBLE COMPANY, NEAR TATE,
PICKENS COUNTY, GEORGIA.

at Ball Ground, where the mill and finishing works are located. The quarry equipment consists of 2 Sullivan channelers, 1 Ingersoll channeler, 2 Sullivan gadders, 1 Ingersoll gadder, 1 62-foot derrick, 1 30-ton hoist, 2 large pumps, 1 60-horsepower boiler, 1 core testing-machine, machine and blacksmith-shops, 4 cottages for employees, and an office. The railroad equipment consists of $9\frac{3}{4}$ miles of standard-gauge track, 1 60-ton Richmond locomotive, and 3 20-ton cars. The mill is a modern structure, and is up-to-date in all of its equipment. It is supplied with 8 gangs of saws, 1 cut-off saw, 1 lathe (14 feet by 18 inches), 2 large, modern double-headed planing machines, 4 12-foot rubbing-beds, 1 counter-sinking machine, 2 overhead travelers for cutting-shed, 1 complete pneumatic plant, 1 overhead 30-ton traveler, an electric plant for lighting the mill, 1 175-horsepower Buckeye engine, 1 100-horsepower boiler, a cutting shed, and a large two-story office. The total number of hands employed by the company at the time of the writer's visit¹ was 105, and the monthly marble output of the quarries was about 10,000 cubic feet.

The price of Amicalola marble delivered on board cars at the mill is as follows:—

ROUGH MARBLE IN BLOCKS

	Per Cubic Foot
Amicalola, Selected	\$2.00
Amicalola, Average	1.50
Amicalola, Building	1.00

MARBLE FROM SAWS

	<i>Superficial</i>				
	$\frac{7}{8}$ or 1 inch	$1\frac{1}{4}$ inch	$1\frac{1}{2}$ inch	2 inch	Cubic Foot
Amicalola, Selected	\$0.25	\$0.33	\$0.40	\$0.55	\$3.00
Amicalola, Average.....	.22	.27	.32	.45	2.50
Amicalola, Best No. 3.....	.20	.25	.30	.35	2.00
No. 3					1.25
Base Strips, Posts and Inferior Bottom Bases.....					1.25

¹ May 7th, 1905

MARKERS

To Set on Base

0.10 to 1.2 long, 0.3 thick, each.....	\$0.35
0.10 to 1.2 long, 0.4 thick, each.....	.50
1.4 to 1.6 long, 0.3 thick, not over 1.2 wide.....	.75
1.4 to 1.6 long, 0.4 thick, not over 1.2 wide.....	1.00

To Set in Ground

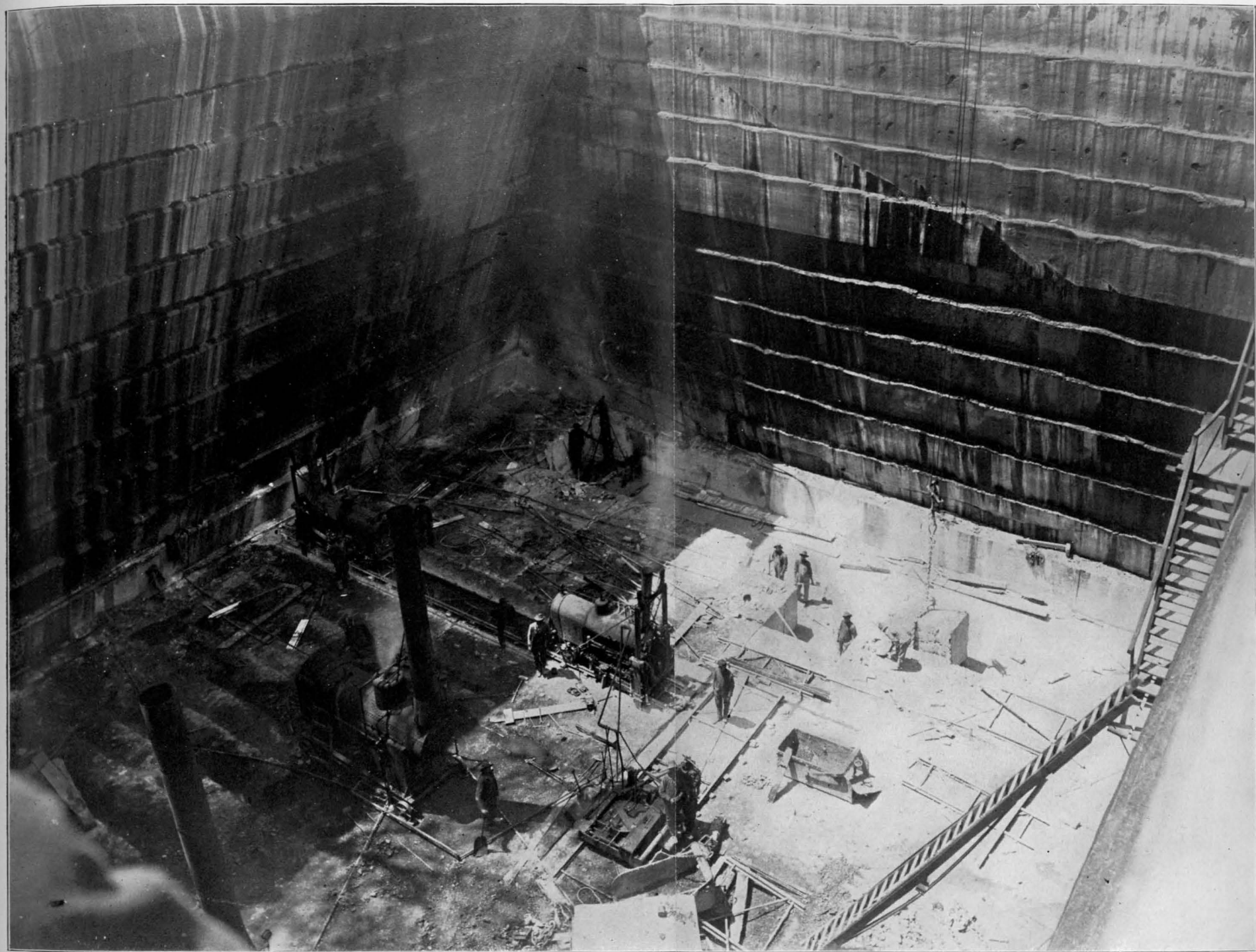
1.8 to 2.0 by 0.10 by 0.3, each.....	.65
1.8 to 2.0 by 1.0 by 0.3, each.....	.75
1.8 to 2.0 by 0.10 by 0.4, each.....	.80
1.8 to 2.0 by 1.0 by 0.4, each.....	1.10
0.3 sawed heads, sand rubbed and boxed, extra, each.....	.20
0.4 sawed heads, sand rubbed and boxed, extra, each.....	.25
0.3 oval tops, sand rubbed and boxed, extra, each.....	.40
0.4 oval tops, sand rubbed and boxed, extra, each.....	.45

Foot Stones

0.5 to 0.8 wide, 0.2 thick, assorted sizes, each.....	.20
Same sizes, S. H.....	.22
Same sizes, S. H. S. R. and Bx., each.....	.28
0.5 to 0.8 wide, 0.3 thick, assorted sizes, each.....	.25
Same sizes, S. H.....	.28
Same sizes, S. H. S. R. and Bx., each.....	.35
If ordered all 0.8 wide, extra, each.....	.05

Specials

Diminished dies and spires, extra per cubic foot.....	.50
Strips, pieces, etc., 2 in. or over in thickness and less than 2.6 wide, ordered 7.0 long, extra, per cubic foot.....	.50
For every additional foot in length, extra per cubic foot.....	.25
Pieces less than 1.6 wide and less than 2 in. in thickness, or- dered 7.0 feet long and under 10.0 feet, extra per superfi- cial foot.....	.05
If ordered 10.0 feet long, extra per superficial foot.....	.10
For every additional foot in length, extra per superficial foot..	.05



CHEROKEE QUARRY, NO I, GEORGIA MARBLE COMPANY, NEAR TATE, PICKENS COUNTY, GEORGIA.

Slabs, 2.6 or over, wide, ordered 9.0 long or 4.6 wide, 2 in. or over in thickness, and for every additional foot in length, or for every additional 6 inches in width, extra, per cubic foot.	.25
Slabs, 1.6 or over, wide, ordered 9.0 long or 4.6 wide, under 2 inches in thickness, and for every additional foot in length, or for every additional 6 inches in width, extra per superficial foot	.05
Sawing edges and ends of slabs 0.2 in thickness and under, per superficial foot	.10

Sand Rubbing

Monumental Stock, per cubic foot	.25
Slabs under 2 inches thick, rubbed sides, per surface foot	.05
Slabs under 2 inches thick, with rubbed edges, extra, per superficial foot	.02½
Charges, same for rubbing ends of slabs as for rubbing edges.	

Boxing

Monumental Stock, per cubic foot	.25
Slabs, 1 in., 1¼ in. and 1½ in., singly per superficial foot	.10
Slabs, 1 in., 1¼ in. and 1½ in., two or more together, per superficial foot	.05

THE GRIFFIN PROPERTY

THE GRIFFIN PROPERTY, which is, at present, *controlled by the Georgia Marble Company*, lies immediately west of the Piedmont quarries, on the same line of outcropping. The marble is exposed at a number of places along the hillside, and it also underlies the creek bottom. That, which occurs along the creek, appears to be the lower part of the stratum, and is, at places, of a flesh color, while that on the hillside is white, with blotches of dark-gray. This line of exposures continues, with few interruptions, along the east side of Longswamp creek for about two and a half miles. At a number of places on this line of outcroppings, a limited amount of prospecting

has been done; but no regular quarrying has been attempted. The dip, as determined at several points, is from 20° to 30° southeast.

THE DARNELL PROPERTY

TWO MILES NORTHWEST OF THE PIEDMONT WORKS, and on the opposite side of a high ridge, marble occurs on *S. A. Darnell's property*. This is an entirely different line of outcropping from the one above described, though the structure of the marble and the character of the associated rock, both show, that it belongs to the same stratum. For nearly two miles, these two lines of exposures run almost parallel with each other; but they seem to finally unite, just before disappearing beneath the gneisses in the lower end of Tate's bottom. The marble is found on this property, outcropping on the hillside, and also in the creek bottom, near the juncture of the two branches of Longswamp creek. It has a somewhat finer texture, than that found at the other exposures in the vicinity; yet, in color and structure, it remains about the same. The dip, though difficult to determine, on account of the limited exposure, appears to be about 20° , almost due east. Very little prospecting has been done here; but, just across the creek, on the adjoining lot owned by Dr. Tate, a number of drill-holes have been put down to the depth of eighty or ninety feet. The cores from these borings are said to show the marble to be generally sound, with a texture and color much like the Creole from the Georgia works.

LOT 82, 4TH DISTRICT

A FEW HUNDRED YARDS WEST OF THIS PROPERTY, and separated from it by a narrow ridge, is a third line of outcropping. It appears first on *lot 82, 4th district, 2nd section*, and continues parallel with the other two lines of exposures, for about one and a half miles, finally disappearing on a hillside near William Tate's residence. Along this line of exposure, some prospecting has been done by boring and sinking pits. This marble does not seem to form such a thick stratum, as at the other exposures farther west; but the dip and general appearance of the stone remain unchanged.

THE QUARRIES AND PLANT OF THE GEORGIA MARBLE COMPANY

The quarries of the Georgia Marble Company are located in the valley of Long Swamp creek, one and a half miles east of Tate station. The valley, here, is nearly half-a-mile in width, the greater part of which is underlain with marble, from six to eight feet beneath the soil. The unusual width of the deposit at this place is due apparently to a fold in the stratum. In making an excavation for the smoke-stack of the Company's mill, a few years ago, it was found that the marble at that point dipped in opposite directions, which locates the centre of the fold, whose upper portion has been removed by erosion. The Creole and Cherokee quarries are located on the west side of the fold; while the Etowah is on the east side.

THE CREOLE QUARRIES. — There are three of the Creole quarries within a few rods of each other, designated respectively as the Old Creole quarry, Creole No. 1 and Creole No. 2. The Old Creole quarry, which was the first quarry opened, is 80 by 100 feet at the surface, 140 by 160 feet at the bottom, and 155 feet deep. Creole No. 2 is 80 by 100 feet at the surface, 140 by 160 feet at the bottom, and 90 feet deep. The marble from each of these quarries is quite free from impurities and seams, and the lines of bedding have been more or less completely obliterated by crystallization; so that stones of almost any dimensions can be obtained. The texture of the marble from these quarries is coarse, and the color is white, clouded or banded with black or bluish-gray which makes a very handsome stone for monuments or for interior decoration. The dark color of the stone, as shown by microscopic examination, is due chiefly to minute clusters of graphite, in the form of foliaceous scales unevenly distributed throughout the large, nearly transparent grains of calcite, which make up the marble.¹ The stone takes an excellent polish and is easily worked.

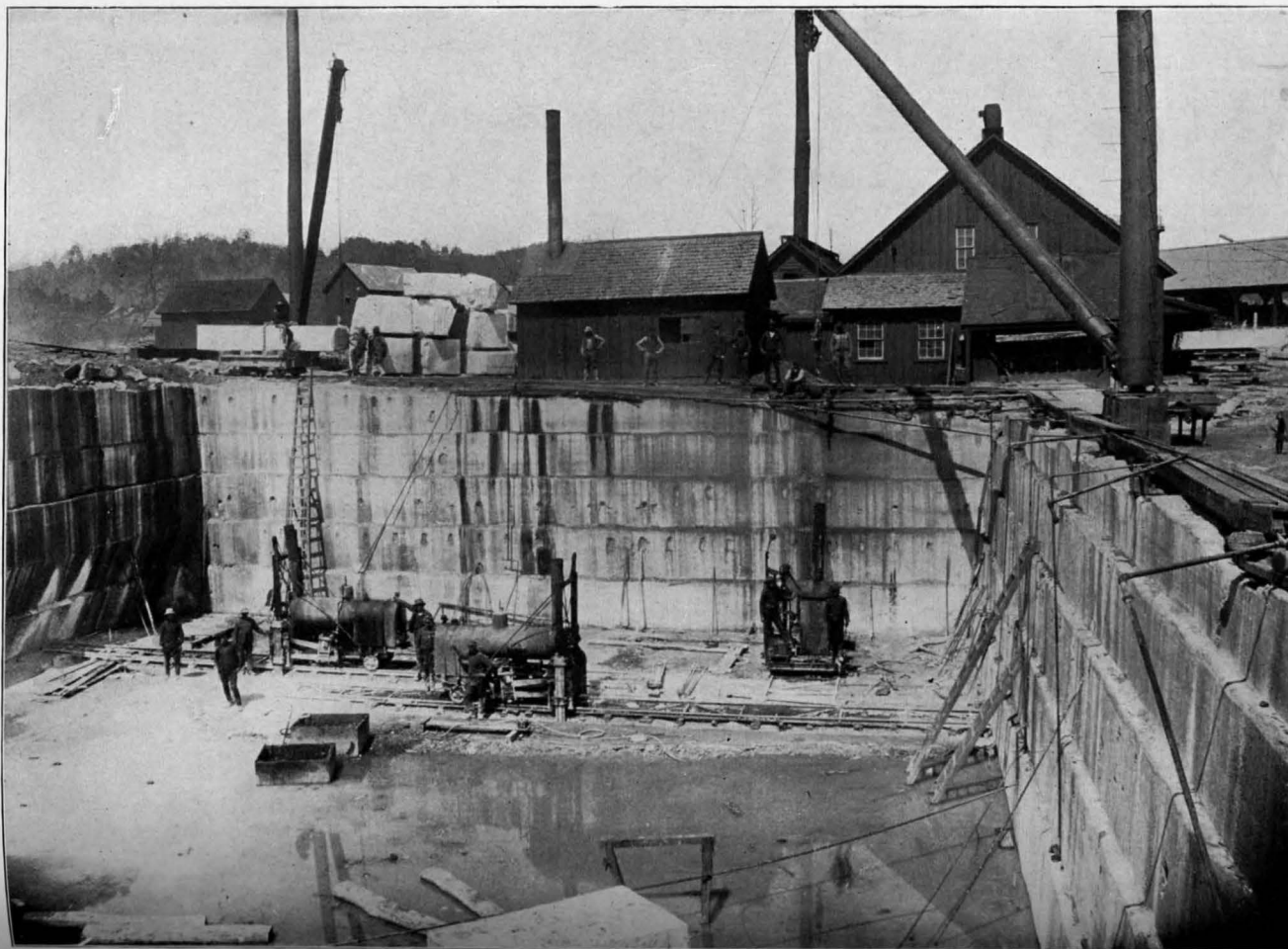
THE CHEROKEE QUARRIES, four in number, are all located within a few hundred feet of each other, and only a short distance from the Creole quarries. These quarries are known as Cherokee No. 1,

¹ See plate XXXII, Fig. 5.

Cherokee No. 2, Cherokee Annex, and the Old Cherokee. The last named quarry, which has not been worked for some time, is 75 by 110 feet at the surface and 100 feet deep. The quarry, known as the Cherokee Annex, now being opened, is 100 by 200 feet, the greatest surface dimensions of any quarry in the district. Cherokee No. 1 is 90 by 100 feet at the surface, 100 by 130 feet at the bottom, and 75 feet deep; while Cherokee No. 2 has the same depth, but is 100 by 120 feet at the surface, and 112 by 146 feet at the bottom. The stone from the Cherokee quarries is similar in texture to the Creole; they differ, however, in color, the Cherokee being lighter; and its coloring matter is more uniformly distributed.

THE ETOWAH QUARRIES are located near Long Swamp creek, about 300 yards east of the Creole quarries. There are two of these quarries, Etowah No. 1 and Etowah No. 2. The former is 90 by 115 feet at the surface and 45 feet deep, and the latter is 90 by 125 feet at the surface and 20 feet deep. The marble obtained from these quarries is different from that obtained from both the Creole and Cherokee quarries. The main difference, however, is confined chiefly to the color and the greater abundance of the accessory minerals. The predominating color is pink or flesh-color, banded, more or less, with white and with the darker shades. The dark bands are due mainly to graphite and biotite; while the predominant flesh color is due, as is shown by Dr. Emerson in Chapter XIII, to finely divided particles of hematite disseminated through the mass. This variety of marble has found an extensive use as wainscoting and tiling. Good examples of this may be seen in the State Capitol, where it is used for the wainscoting of the first floor, and in the beautiful slabs on exhibition in the Georgia State Museum.

THE KENNESAW QUARRIES. — In addition to the quarries above described, the Georgia Marble Company owns three quarries on the east fork of Long Swamp creek, at the base of the north side of Marble Hill, about four miles east of Tate station. This group of quarries is known as the Kennesaw quarries, which are designated as Kennesaw No. 1, Kennesaw No. 2 and Kennesaw No. 3. Kennesaw No. 1 is 80 by 80 feet at the surface and 100 feet deep; No.



CHEROKEE QUARRY NO. 2, GEORGIA MARBLE COMPANY, NEAR TATE, PICKENS COUNTY, GEORGIA.

2 is 80 by 120 feet at the surface and 80 feet deep, and No. 3, which is just being opened, is 135 by 150 feet. These quarries all furnish white marble, similar to that of the Southern Marble Company. It is much used for building and interior decoration, as well as for monumental purposes.

The only quarries of the Georgia Marble Company, now operated, are as follows: Creole Nos. 1 and 2; Cherokee Nos. 1 and 2; Cherokee Annex and Kennesaw No. 3. These quarries, during the month of March last, furnished 60,000 cubic feet of stone. The mode of weathering of these marbles is well illustrated by various outcroppings in the vicinity of the quarries. This is also well illustrated by the marble at Col. Stephen Tate's residence, which is said to have been quarried by the Cherokee Indians, prior to their removal from North Georgia by the United States Government. These stones, although exposed under dripping eaves for more than half-a-century, show but little signs of weathering; and they still retain in remarkable degree of perfection their sharp edges and corners.

The quarry equipment and mill of the Georgia Marble Company is very complete, being one of the most extensive and up-to-date plants of the kind in the South. The large mill is supplied with 34 gangs of saws, one cut-off circular saw, two 12-foot rubbing beds, three lathes and one polishing machine, all of which are operated by 1 300-horsepower engine, the steam being furnished by 3 100-horsepower boilers. The mill is also supplied with a dynamo and electric-light plant, so that it can be operated both day and night. The quarry equipment consists of 10 double channelers, 6 single channelers, 11 gadders, 8 steel 60-foot derricks, 13 boilers, varying from 15 to 100-horsepower, to operate channelers, gadders, etc., and 8 hoists. In addition to the equipment above enumerated, the company owns 1 traveling derrick 620 by 60 feet with a storage capacity of 1,500 blocks of 10 tons each; 1 complete machine-shop and 2 blacksmith-shops; 7 miles of standard-gauge railroad track, 2 locomotives, 10 60,000-pound freight cars, 51 cottages for employees, 1 large warehouse, and 1 well arranged office-building. The entire plant and quarries, together with the stock-yard, covers nearly 20

acres. The total number of employees of the Company at the time of the writer's visit (May 7, 1905) was 252.

The trade names and the price of the stone, which the Georgia Marble Company places on the market, is given in the following table:—

Blocks from Quarry

Kennesaw	from \$.50 to \$1.25
Etowah	" 1.00 to 1.75
Creole	" .50 to 1.25
Cherokee	" .50 to 1.25

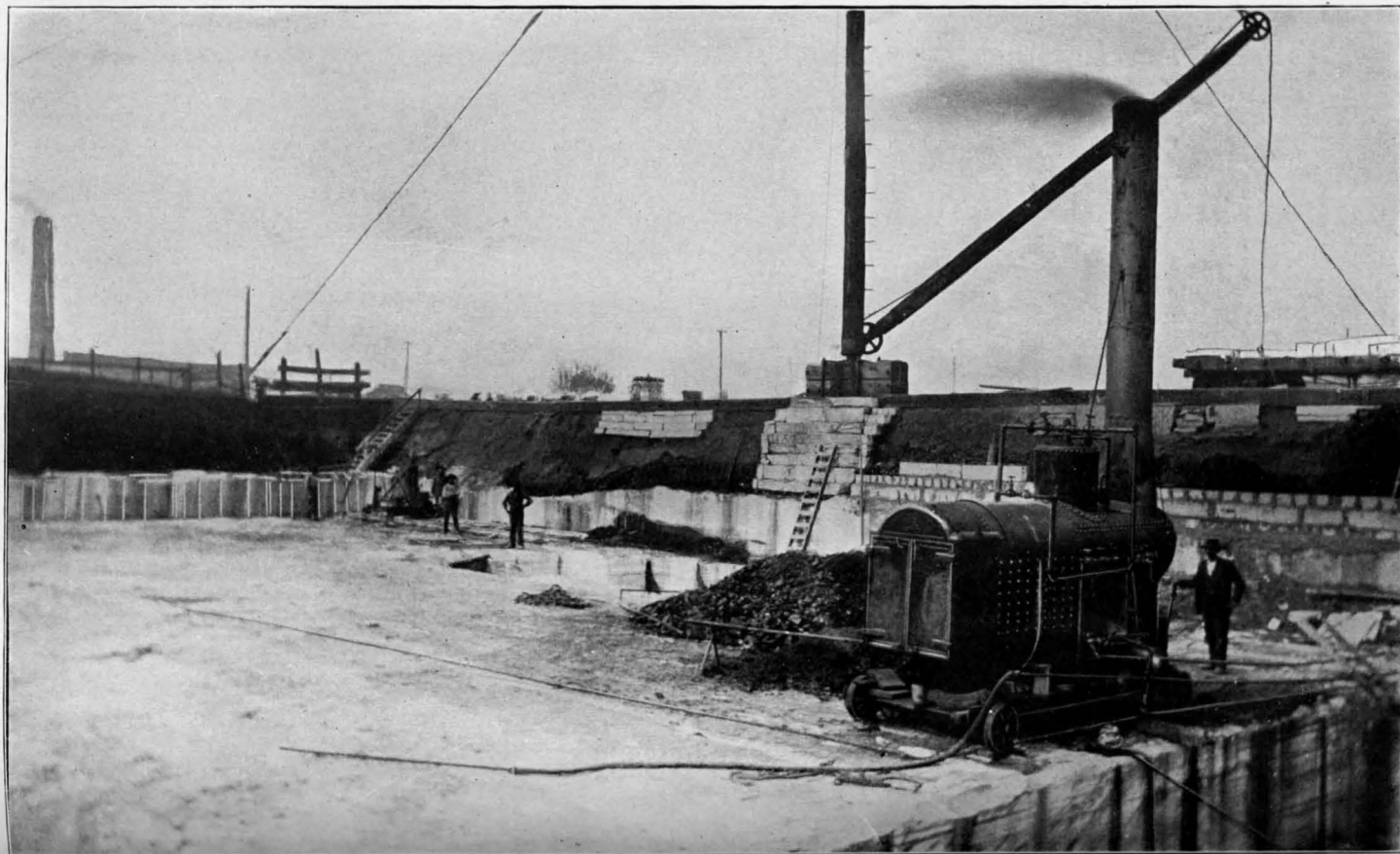
Slabs

Full Size of Block, per Superficial Foot

Kennesaw, Creole and Cherokee, Select, $\frac{7}{8}$ in. to 2 in	\$.25 to \$.55
Kennesaw, Creole and Cherokee, Average, $\frac{7}{8}$ in. to 2 in .....	.22 to .45
Kennesaw, Creole and Cherokee, Best No. 3, $\frac{7}{8}$ in. to 2 in.....	.20 to .35
Etowah, Select, $\frac{7}{8}$ in. to 2 in.....	.45 to .80
Etowah, Average, $\frac{7}{8}$ in. to 2 in.....	.35 to .70
Slabs, over 4 feet wide or over 7 feet long, 10 to 25 per cent. extra.	
Slabs, coped to size, 10 cents per superficial foot extra.	
Boxing, $\frac{7}{8}$ in. thick to 2 in. thick, per superficial foot.....	05c
Boxing 2½ in. thick, per superficial foot.....	10c
Sand rubbing, per superficial foot.....	05c

Monumental Stock

	Per Cubic Foot
Creole, Cherokee and Kennesaw, Select.....	\$3.00
“ “ “ “ Average	2.50
“ “ “ “ Best No. 3.....	2.00
Etowah, Select	5.00
“ Average	4.00
“ Best No. 3.....	3.00
“ No. 3	1.25



THE GEORGIA MARBLE COMPANY'S ETOWAH QUARRY NO. 2, NEAR TATE, PICKENS COUNTY, GEORGIA.

Miscellaneous

No. 3 Base strips, posts and bottom bases, per cubic foot.....	\$1.25
Markers, 20 to 24 inches long by 10 x 3 inches.....	.65
Markers, 20 to 24 inches long by 12 x 3 inches.....	.75
Markers, 20 to 24 inches long by 10 x 4 inches.....	.75
Markers, 20 to 24 inches long by 12 x 4 inches.....	1.00
Markers, 20 to 24 inches long by 14 x 4 inches.....	1.15
Foot Stones, 4 to 8 inches wide by 2 inches thick.....	.20
Foot Stones, Same size, sawed heads.....	.22
Foot Stones, Same size, sawed heads, and sand rubbed.....	.25
Foot Stones, Same size, sawed heads, sand rubbed and boxed.....	.28
Diminished dies, extra, per cubic foot.....	.50

MARBLE AT NELSON

At Nelson, the first station south of Tate, marble outcrops near a spring, located about 200 yards south of the depot. The exposure is confined to a few outcroppings, whose weathered surfaces resemble, in general appearance, the white and fine-grained marble found in Long Swamp valley.

Some prospecting has been done here; but neither the quantity nor the quality of the stone is said to have been sufficiently promising, to justify opening a quarry.

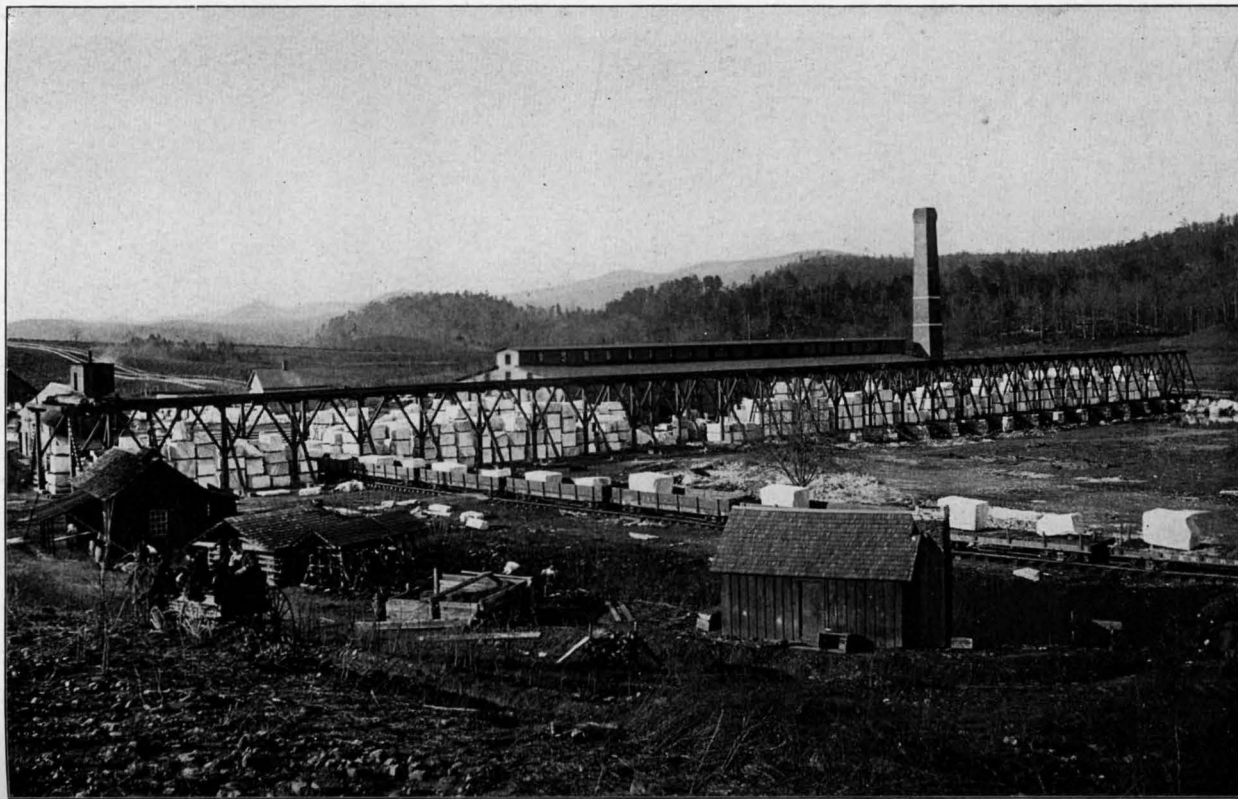
CHAPTER VII

THE MARBLES OF CHEROKEE COUNTY

Cherokee county has long been known to contain more or less marble; but it has never become an active producer. The same stratum of marble, which is so well developed in Fannin, Gilmer and Pickens counties, occurs, also, in Cherokee. The exposures here, however, are not so extensive nor so continuous. They seem to be more or less disconnected, as if misplaced by faults.

In this county, the dark and rather impure marble, which was first noticed in Pickens and Gilmer counties, becomes quite well developed, and forms, at places, beds of considerable thickness. There has been a limited amount of prospecting done for marble at a number of localities in this county, though no regular quarries have been opened. The so-called green marble, which has been and is now being worked near Holly Spring, and which has attracted considerable attention as an ornamental stone, is serpentine, under which head it will be discussed in chapter XV. This stone is known to the trade as Verd Antique marble.

FOUR MILES NORTHEAST OF BALL GROUND, at the bridge on the road leading to Dawsonville, the stratum of dark colored marbles first make their appearance in Cherokee county. From this point, it forms a series of outcroppings about ten miles long, extending in a southwestern direction, by way of Ball Ground, to within a short distance of Canton, where it seems gradually to thin out. At the above named bridge, it is exposed on both sides of the road, west of the creek, and has been used in constructing the piers of the bridge. Some of the layers are very impure. They consist of micaceous sandstones, cemented with calcium carbonate, and weather into a porous, sandy mass. Other layers have few impurities, are of a light-gray color, and weather more evenly. The stone



WORKS OF THE GEORGIA MARBLE COMPANY, NEAR TATE, PICKENS COUNTY, GEORGIA.

found here appears to be too much laminated, and generally contains too many impurities to be well suited, either for building or for ornamental purposes.

THE HALBERT PROPERTY

ON J. HALBERT'S PROPERTY, *lots 259 and 260, 4th district, 2nd section*, southwest of the bridge, on the right bank of Longswamp creek, the dark-colored marble makes its appearance a second time. It is exposed at a number of places along the creek, and in the field near the house. The stratum attains a thickness, here, of at least one hundred feet, and dips to the southeast at an angle of about 30°. At the time of our visit, no prospecting of any consequence had been done on this property, and our examination was, therefore, confined to the natural exposures. The stone in different outcroppings varies considerably, both in structure and in composition. At some places, it has a more or less slaty structure, due mainly to the abundance of mica; while, at others, it is solid, and comparatively free from mica and other impurities. The color is usually a dark-gray; but a light-gray and a black are also found. The latter seems to be well suited for tiling; but it does not weather evenly, on account of the impurities, which it contains.

LOT 296, 4TH DISTRICT

ON THE OPPOSITE SIDE OF THE CREEK FROM THE HALBERT PROPERTY, a coarse-grained, white marble has been recently discovered on *lot 296, 4th district, 2nd section*. It is exposed at only one place, in a small stream near the point, where it empties into the creek. The stone found here resembles the marble in the vicinity of the Georgia Marble Quarries, and probably belongs to the same stratum. As no prospecting of any consequence has been done on the property, nothing is known of the extent of the deposit. The dark-colored marble is exposed along the road between the Halbert property and Ball Ground at a number of places. It shows up especially well at Farmer's Spring, where it is asso-

ciated with a very coarse-grained gneiss. The general character of the stone found here is about the same as that at other exposures, and requires no further description.

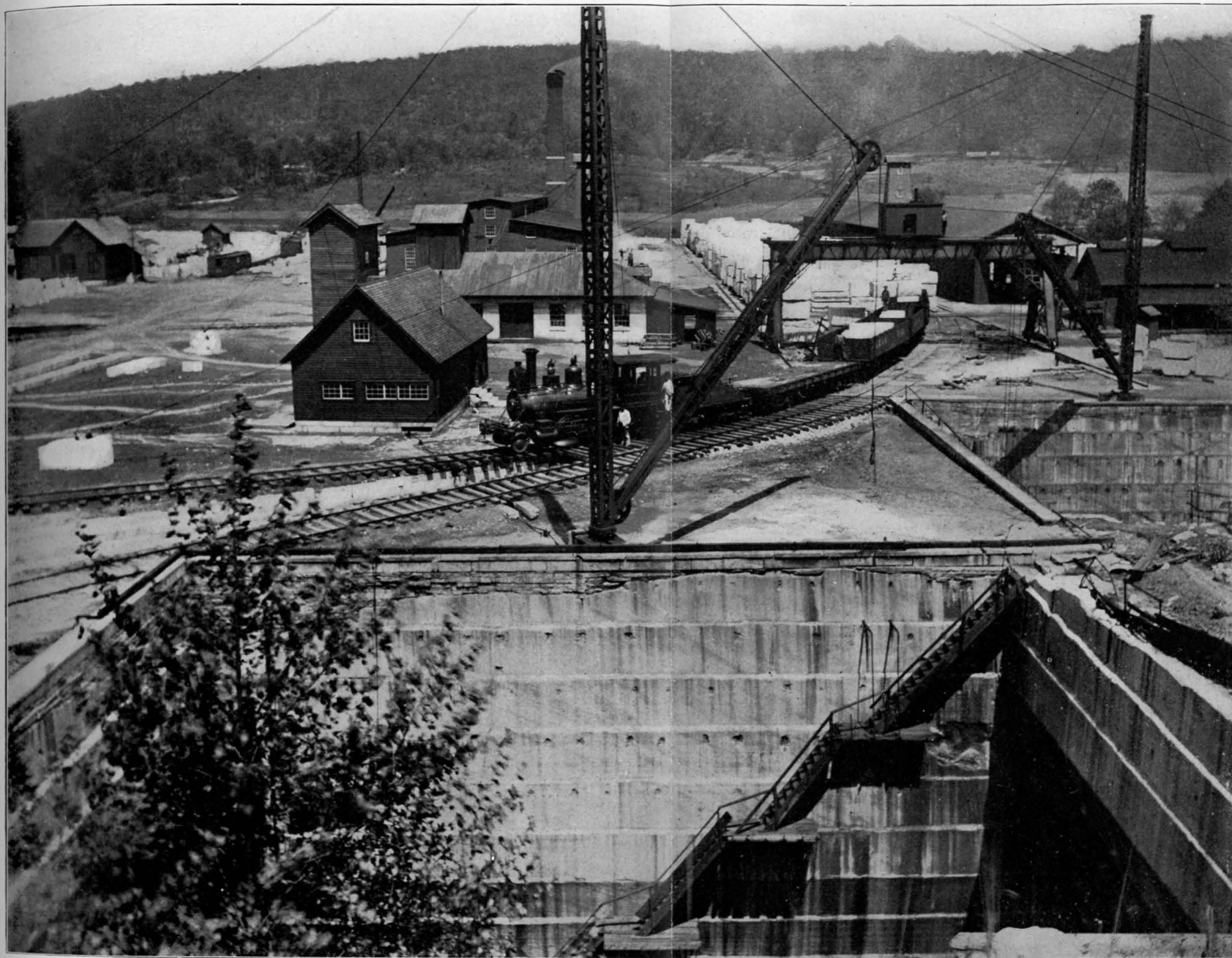
MRS. STEARNE'S PROPERTY

THREE-QUARTERS OF A MILE SOUTH OF BALL GROUND, near the road leading to Canton, is an exposure of marble on Mrs. Stearne's property. It occurs here at a number of places along a small branch. The exposed surfaces are usually unevenly weathered, which is due to mica and other impurities found more or less abundant in the stone. It is of a dark-gray or black color, very fine-grained, and admits of a fair polish; but it has a somewhat laminated structure. At a number of places on the road leading to Canton, there may be seen other outcroppings, which belong to the same stratum.

THE CRAIN PROPERTY

NEAR MABEL STATION, six miles northeast of Canton, is quite an extensive exposure of dark-colored marble. It outcrops, here, along two small streams *on property owned by G. W. Crain*. One of these streams runs at almost right angles to the strike of the marble, and exposes it for more than one hundred yards. The total thickness of the deposit, here, must be at least one hundred and twenty-five feet. At the time of our visit, J. W. Jarvis, who holds an option on the property, was having some drill-holes put down, here; but the work had not then been carried to a sufficient extent to give any definite results. The color is black or dark-gray. Sometimes, these colors alternate with each other, which gives to the stone a banded-like appearance. The impurities are chiefly mica and magnetite, with an occasional crystal of pyrite.¹ These frequently become so abundant along definite lines, as to cause a slate-like cleavage and irregular weathered surfaces. The more solid portion of the stone found here admits of a fair polish, and seems

¹ See plate XXXI, Fig. 1.



ANOTHER VIEW OF THE WORKS OF THE GEORGIA MARBLE COMPANY, NEAR TATE, PICKENS COUNTY, GEORGIA, SHOWING ONE OF THE QUARRIES IN THE FORE-GROUND.

to be well suited for tiling etc.; but it usually contains too many impurities to make it desirable for outdoor work. The last exposure examined on this line of outcropping is about two miles west of Canton, on the Chattahoochee Mining Company's property, where it has been used for making lime. It is here very much reduced in thickness, and is of no economic importance as a building-stone.

THE STAFFORD PROPERTY

ON SHARP MOUNTAIN CREEK, two miles west of Ball Ground, is a second line of marble outcroppings, which appears to be a part* of the same stratum, that has just been described. It extends in a southwesterly direction, parallel with the first line of outcropping, as far south as Hickory Log creek, where it has been prospected on *P. W. Stafford's property*. The marble found here is much like that, in the vicinity of Ball Ground; but it is much whiter.

THE COWART PROPERTY

THREE MILES SOUTHWEST OF BALL GROUND, marble occurs on *L. E. Cowart's property, lot 305, 3rd district, 2nd section*. It is exposed here along a small branch near Sharp Mountain creek. In texture and color, the marble resembles very closely that, which occurs in Longswamp valley; and it probably belongs to the same stratum. It has rather a coarse grain, and a white or light-gray color, banded with black. A flesh color, much like the Etowah, also occurs; but it does not appear to be very abundant. From the limited outcropping, it was impossible to tell anything very definite about the extent and the general soundness of this deposit; but surface indications are favorable, and seem to warrant at least a limited outlay of money in prospecting.

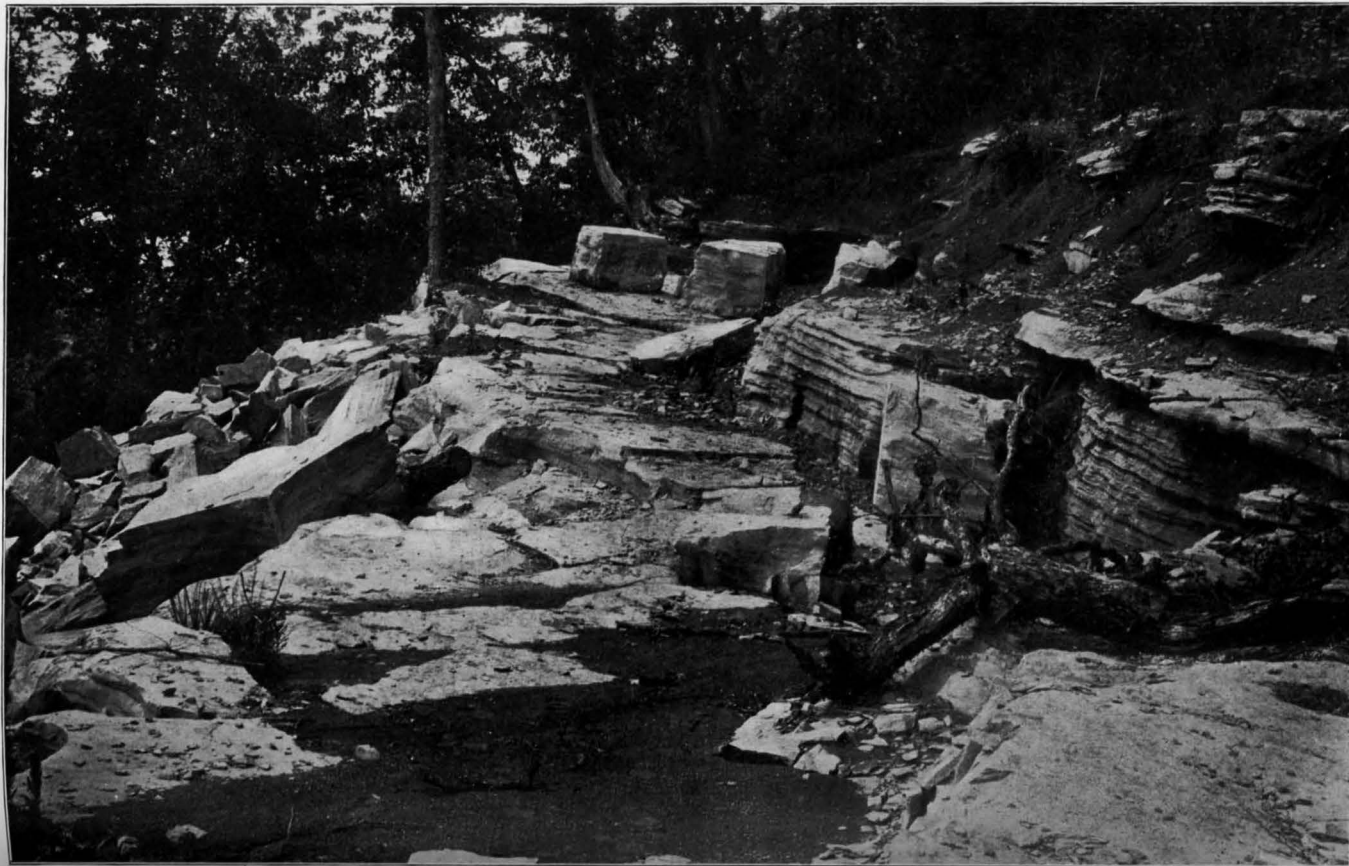
THE CARPENTER PROPERTY

ON RAGSDALE CREEK, six miles northwest of Canton, marble is found on *lot 103, 14th district, 2nd section, owned by T. J. Carpenter*. It outcrops here at only one place on the hillside; but by

sinking pits a few feet beneath the surface, it has been found underlying a small area in the creek bottom. Hand specimens of this stone are difficult to distinguish from the Cowart marble, and they evidently belong to the same stratum. The deposit does not appear to be very thick, and is usually unsound.

THE WHITE PROPERTY

AT THE JUNCTION OF LOST TOWN AND SHOAL CREEKS, about eight miles northwest of Canton, quite an extensive outcropping of marble appears *on lots 196 and 200, 22nd district, 2nd section, owned by J. M. White.* It is exposed for fully a quarter of a mile along the left bank of Lost Town creek, forming in places, bluffs several feet in height. The marble occurring here is generally sound; it contains fine sand, and is of a light-gray or pale-blue color. It dips to the southeast at an angle of 30° ; and, judging from the width of the exposure, the stratum must be nearly eighty feet in thickness. At the time of our visit, no prospecting had been done on this property.



A VIEW SHOWING OUTCROP OF BLACK MARBLE AT THE QUARRY OF THE AMERICAN BLACK MARBLE COMPANY,
WHITFIELD COUNTY, GEORGIA.

CHAPTER VIII

THE SEMI-CRYSTALLINE MARBLES OF NORTHWEST GEORGIA

In a number of counties, within the Paleozoic area in Northwest Georgia, partly crystalline limestones occur. They are often heavy-bedded, and admit of a good polish. At a few places, in the counties below named, this stone may become of importance for economic purposes.

WHITFIELD COUNTY

THE CEDAR RIDGE PROPERTY

FIVE MILES EAST OF DALTON, at the base of Cedar Ridge, a great deal of work has been done in opening a quarry in the so-called black marble; but no merchantable stone, of any consequence has ever been put upon the market from this place. This stone, which has here been prospected, is a jet-black, carbonaceous limestone, belonging to the Oostanaula Shales, and occurs in beds, from six inches to two feet in thickness. It shows but little evidence of crystallization; but it admits of a fair polish. When struck with a hammer, the stone emits a peculiar odor, very similar to petroleum, and gives a beautiful conchoidal fracture. If exposed to the atmosphere, for any length of time, it undergoes a change in color, which is evidently due to some chemical change in the carbonaceous material. The thin beds, together with its change of color, is a serious drawback to this stone's ever becoming of any economic importance, as an ornamental stone.

THE AMERICAN BLACK MARBLE COMPANY'S QUARRY

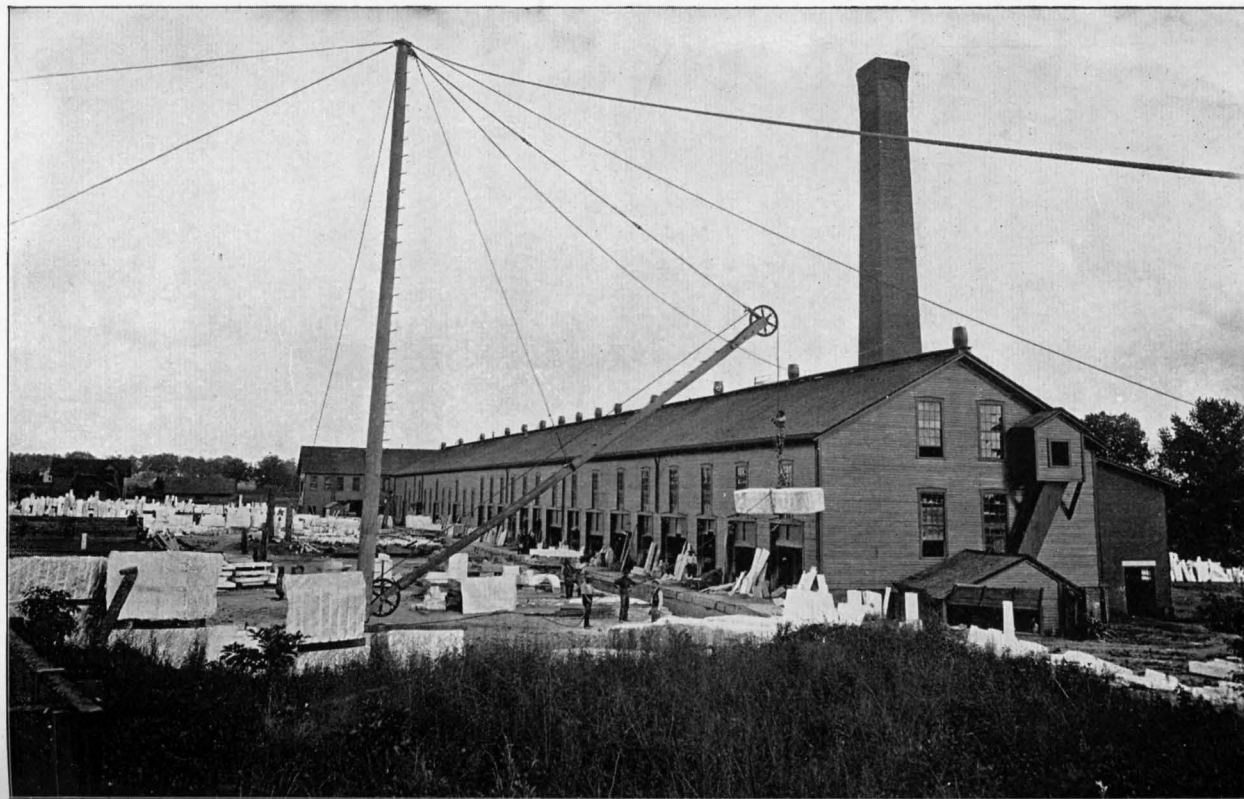
About half-a-mile north of the quarry above referred to, and only a short distance from the Coahulla creek, the American Black Marble Company did considerable work in 1903, in an unsuccessful

attempt to discover black marble in commercial quantities. The main works, which consist of two openings, are located on a steep hill-slope. The excavations are only a few feet deep and less than 50 feet in length. The stone exposed in each excavation is a dark, impure partially crystalline limestone, showing, more or less distinctly, lines of lamination. The last named characteristic of the stone is best seen on the weathered outcrops. Interlaminated with the stone, occurs thin layers of black shale, with an occasional nodular concretion of black chert. The total thickness of the formation at this point appears to be about 300 feet. The natural exposure of the stone along the hill-side, which so well illustrates its character, would seem to have convinced almost any marble man that it was useless to expend money here, with a view to securing a first class ornamental stone.

THE VARIEGATED MARBLES

There occurs in the northwest corner of Whitfield county a narrow belt of dark-chocolate and grayish marbles, highly fossiliferous. It enters the county from Tennessee, about one mile east of Red Clay, and extends nearly parallel with the East Tennessee, Virginia and Georgia division of the Southern Railway, for about ten miles. It is well exposed about one mile east of Varnell's Station, on the Eslinger farm. This marble belongs to the same stratum, which traverses the valley of East Tennessee, and which is so extensively worked in the vicinity of Knoxville.

The color of the stone is quite variable. It is generally of a dark-chocolate color, variegated with white; but there also occurs, in more or less abundance, a light-gray and a beautiful pink. These various colors are frequently found at the same place, occupying different layers of the same stratum, or they may blend into one another, so that almost any shade of color, from a dark-chocolate to a light-gray, can be secured. The light-gray, which is always the most solid and the most completely crystallized, is generally traversed by dark, irregular lines, that add variety to an otherwise monoto-



A VIEW OF THE MARBLE-DRESSING WORKS OF THE KENNESAW MARBLE COMPANY, NEAR MARIETTA, GEORGIA, SHOWING HOW LARGE BLOCKS OF MARBLE ARE EASILY HANDLED WITH THE DERRICK.

nous light-gray surface. The exposures are mostly in the form of boulders, or large disconnected masses, which appear to be due to the surface weathering of thick layers of marble, with a somewhat jointed structure. As this peculiar mode of weathering has been caused entirely by surface waters, carrying carbonic acid in solution, it is reasonable to suppose that the boulders and the disconnected masses unite to form continuous beds, at no great depth. These beds, making up the stratum of marble, as shown by the outcroppings, are from two to eight feet in thickness, and lie within a synclinal fold, of a ferruginous calcareous formation, called, by Dr. Safford, iron-limestone.

It is difficult to determine the exact thickness of the marble deposit at any point along the belt, on account of the overburden of earth and the limited outcrops. However, one would be on the safe side, in putting the minimum thickness at thirty to forty feet. *On the Hoskin farm*, one mile southeast of Red Clay, it attains probably more than twice this thickness; but it is not all merchantable stone.

The microscopical and chemical analyses of the light-gray varieties of marble, show them to be nearly pure calcium carbonate, almost crystalline, with rarely any trace of organic remains. These chemical and physical properties, together with the smooth surface of the stones, exposed for years in the natural bed, are conclusive proofs, that the marble is well suited both for building and ornamental purposes.

The dark-chocolate variety has less calcium carbonate, and numerous fossils, and is only partly crystalline; but, owing to its beautiful color and brilliant finish, it is well adapted for furniture and interior decoration.

ON THE ESSLINGER FARM, the marble was worked, many years ago, to a limited extent, into tombstones, some of which are still to be seen in the churchyards of the vicinity, in a fair state of preservation. The stone used for that purpose was mostly obtained from boulders, and worked into the desired shape by hand. At other

places along the line of outcropping, where the marble becomes thin-bedded and is easily quarried, it has been used locally in making chimneys, foundations for buildings, etc.

The marble belt of Whitfield county is very favorably located for the shipment of stone. Branch lines can easily be constructed from the main line of the Southern Railway, along the numerous small streams, which cut through the ridge separating the marble belt from the railroad. Some of these streams are of sufficient size, and have enough fall, to give considerable water-power, that might be easily utilized in operating quarrying machinery.

FLOYD COUNTY

THE SIX-MILE STATION PROPERTY

About seven miles south of Rome, near Six Mile station, a considerable amount of money was spent, a few years ago, in a black semi-crystalline limestone, belonging to the same formation, as that which has been worked for marble at the base of Cedar Ridge, in Whitfield county. The stone found here seems to have been much shattered and broken up, by some great dynamic force, and to have been again united by veins of white crystalline calcite. These white veins penetrate the stone in every direction, and give to it a very pleasing effect, when polished. A branch road nearly two miles in length was graded from this quarry to the main line of the Southern Railway, and quarrying machinery was purchased and put in operation; but the works were finally abandoned, before any stone was put on the market. The principal difficulty encountered, in using this stone for ornamental purposes, seems to be due to its unsound condition and its variable physical structure.

CHAPTER IX

MARBLE-DRESSING AND FINISHING-WORKS

The following is a short description of the larger marble-dressing and finishing-works, within easy access of the marble quarries. These, although not connected with any quarries, are, nevertheless, very important factors in the marble industry of the State.

THE KENNESAW MARBLE COMPANY

The Kennesaw Marble Company was organized August 15th, 1891, with a capital of \$100,000.00. The plant operated by this company is located near Marietta, at the junction of the Western & Atlantic and the Louisville & Nashville Railroads. It consists of a large mill, 420 by 80 feet, a machine shop, a power-house, a packing and shipping building, etc. The mill is supplied with 15 gangs of saws, one circular cut-off saw, 3 rubbing-beds, 2 polishing-beds, 4 lathes, 2 large cutting-machines, one moulding machine, one counter-sinking machine, and 2 electric dynamos. The machine shop is large, and is well supplied with all the machinery necessary to make or keep in repair all parts of the mill and the tools used in cutting and carving the marble. With these various labor-saving machines and equipments, the company is able to turn out a great deal of excellent work at a comparatively small expense. A 200-horsepower Brown engine supplies all necessary power to run the machinery. One of the electric dynamos, which is located in the engine room, furnishes the building with incandescent lights. This enables the mill to run day and night, which is often necessary, to fill pressing orders. The firm makes a specialty of monumental work and interior finish; though it is able to do all kinds of work, for which marble is used. It deals exclusively with contractors and retail dealers, and has worked up a very extensive trade in all the leading

cities of the United States. The greater part of the marble used by this company is from the quarries of the Georgia Marble Company in Pickens county. The output of the Kennesaw Marble Company, in the last few years, shows that the demand for Georgia marble is rapidly increasing. This, with the outputs of other large manufacturers of this marble, indicates that it has become one of the most popular of ornamental stones. The Kennesaw Marble Company has furnished from Georgia marble the interior finish for some of the most costly buildings erected in the country. Among these, may be mentioned the Custom-house at Chattanooga, the new city-hall at Richmond, Va., and one of the corridors in the new congressional library at Washington, D. C., the last named being wainscoted with a very rich and beautiful quality of Creole marble. Many of the more expensive monuments of Georgia marble, which have been erected throughout the South, were made by this company, who sell them to the local retail dealers ready for erection. The number of hands employed varies from time to time, the usual number being about 100; though, when large contracts are to be filled on short notice, as many as 150 or more hands are frequently employed.

THE BLUE RIDGE MARBLE COMPANY

The works of the Blue Ridge Marble Company, located at Nelson, Pickens county, on the Louisville & Nashville R. R., three miles southeast of Tate, is one of the most complete and thoroughly equipped marble plants in the State. This company, which was organized in 1886, with a capital stock of about \$100,000.00, makes a specialty of interior work; but it also carries on an extensive monumental business, besides furnishing stone of all kinds for general building purposes. The works, being within a short distance of the several marble quarries in Long Swamp valley, and connected with them by railroad, are quite favorably situated for the selection of any material, which may be desired, in filling various orders. The marble-yard of the company, laid out on both sides of the railroad, covers about 20 acres, and is usually well stocked with sawed blocks and slabs, ready to be worked, on short notice, into any desired shape



THE MARBLE WORKS OF THE MCNEEL MARBLE COMPANY, MARIETTA, GEORGIA.

or form. This display of the various grades and colors of the Georgia marble invariably attracts the attention of the traveler from the car-window, and is always an object of general comment.

The main building of the Blue Ridge Marble Company is 80 feet wide and 360 feet long. The equipment of the plant consists of 16 gangs of saws, 5 12-foot rubbing-beds, 2 circular cut-off saws, 1 sash cut-off saw, 1 large and 1 small planer, 1 large lathe for turning columns, 3 small lathes, 50 pneumatic tools, 4 polishing-machines, 1 large locomotive crane (25 tons), 1 small locomotive crane (15 tons), 1 200-candlepower dynamo, 2 air-compressors, 2 100-horsepower boilers, 1 200-horsepower engine, and $\frac{1}{2}$ mile of standard-gauge railroad track. The writer was informed, that it is the intention of the company to increase the size of their plant in a short time, by the addition of 12 gangs of saws and the construction of a large cutting-shed. With these additions, the plant will probably be one of the largest in the South.

The Blue Ridge Marble Company, which, at present, has under lease, and is now operating, the mill of the Marble Hill Quarry Company at the Piedmont quarries, employs about 160 men. Some idea may be had of the character of the work of this company, when it is stated, that their handiwork is to be seen in the interior decoration of the famous Betz building, one of the most beautiful structures in Philadelphia; the Drexel Institute of the same city; St. Cecilia's church of Brooklyn, N. Y.; and, also, that magnificent building, the Auditorium at Chicago.

MESSRS. GEO. B. SICKELS & COMPANY

The mill and shops of Messrs. Geo. B. Sickels & Co. are located within a few hundred yards of the Georgia Marble Company's works near Tate, where blocks of marble, of any desired shape and color, can be readily selected from the extensive stock always kept on hand. The firm was organized in 1886, with a capital-stock of \$10,000; but, since then, the works have been greatly enlarged, in order to supply a rapidly increasing trade. They manufacture exclusively from Georgia marble all kinds of interior finish, making a

specialty of tiling and wainscoting. These find their way to all parts of the United States, and are generally commented upon, on account of the superior quality of the stone used and the excellent workmanship. The plant is supplied with 6 gangs of saws, 3 12-foot rubbing-beds, 3 lathes, 1 planer, 1 dynamo, 2 air-compressors, 1 polishing-machine, 2 drill presses, 1 counter-sinking machine, and a large derrick for handling the stone. The motor-power is furnished by a 120-horsepower engine, supplied by a 175-horsepower boiler. In addition to the main mill, there are, also, cutting and carving sheds, and an office.

The firm employs about 75 hands, and turns out monthly from 20,000 to 25,000 tiles, besides a great deal of wainscoting and monumental work, as well as various kinds of carved work.

THE GEORGIA MARBLE-FINISHING WORKS

The Georgia Marble-finishing Works, which are located at Canton, have been in operation for about 15 years. These works have rapidly grown from a very small beginning to one of the most extensive works of the kind in the State. Originally, the works occupied a small brick building, not over 40 feet long and less than 30 feet wide; but, to-day, the works together with the marble yard, which is always well stocked with marble, cover an area of nearly 2½ acres. It now gives regular employment to about 80 hands, and is doing a very extensive business in monumental work and exterior and interior finish. The main building is quite large, being occupied by the mill proper, the carving department, and the finished stock-room. The equipment consists of 9 gangs of saws, 1 circular cut-off saw, 1 sash cut-off saw, 3 12-foot rubbing-beds, 2 lathes, 1 polishing-machine, 30 pneumatic tools, 1 air-compressor, 1 150-horsepower boiler, 1 100-horsepower engine, and 1 60-foot derrick. The company also has a large office, and all other necessary equipment for carrying on a successful marble-finishing business.

The following price-list is taken from the company's handsomely illustrated catalogue issued last year:—



OFFICE AND WORKS OF THE BUTLER MARBLE AND GRANITE COMPANY, MARIETTA, GEORGIA.

CREOLE, KENNESAW AND CHEROKEE MARBLES

Sand-rubbed and Boxed

	Per Cubic Foot
Select	\$3.50
Average	3.00
Best No. 3	2.50
No. 3	2.00
No. 3 Base-strips and Posts	2.00
Inferior Bottom Bases	1.75

Markers

12 to 14 inches long, 3 inches thick, sand-rubbed and boxed ..	\$0.55
12 to 14 " " " " " " " " ..	0.80
16 to 18 " " " " " " " " ..	1.00
16 to 18 " " " " " " " " ..	1.25
Foot-stones, sand-rubbed and boxed .....	.25

Lettering

Inscription letters, raised or sunk, each .....	.05
Verse-letter, each .....	.03
Large, raised letters on base, each .....	.50
Large, sunk letters on base, each .....	.25

Plain Headstones

Square, round, bevel, o-gee, apex and oval tops, finished, boxed and on cars.

Faces, edges and tops polished, backs fine sand-finished.

	Per Cubic Foot		
	2 in.	3 in.	4 in.
Select, 2.0 feet by 1.0 foot and larger	\$6.00	\$5.00	\$5.00
Average, same size	5.00	5.00	4.50
Best No. 3, same size	5.00	4.50	4.00
Headstones smaller than 2.0 feet by 1.0 foot, extra per cubic foot .....			.50
Mortises, extra, each .....			.75
Tenons, extra, each .....			.75

THE M'NEEL MARBLE COMPANY

The McNeel Marble Company, located at Marietta, began work on a small scale about 14 years ago. The business of the company has since rapidly increased, from year to year, and the plant, at the same time, has been correspondingly improved and enlarged. The company, which is now capitalized at \$50,000, is chiefly engaged in monumental work. In addition to the large plant in Marietta, the company also has branch houses in Gainesville and Cordele. The works, together with the marble yard in Marietta, cover nearly three acres, the main building being 50 by 225 feet. The equipment consists of 2 12-foot rubbing-beds, 2 lathes, 1 polishing-machine, 1 circular cut-off saw, 1 pneumatic surfacing-machine, 25 pneumatic tools, 1 air-compressor, 2 30-horsepower engines, 1 75-horsepower boiler, and derricks. The plant is modern, and can do all kinds of monumental work in a first-class manner. The large yard enables the company to keep constantly on hand sufficient stone to fill all orders without delay. The company, besides employing stone-carvers, also employs special designers who originate and get up new designs for the trade. The total number of hands employed by the McNeel Marble Company at the time of the writer's visit¹ was 75.

THE BUTLER MARBLE AND GRANITE COMPANY

The Butler Marble and Granite Company, which has an authorized capital stock of \$75,000, is located on the Western & Atlantic R. R., at Butler's station, one mile south of the Marietta depot. This company designs and manufactures for the trade all kinds of monuments. About 75 per cent. of the stone, used, is Georgia marble. The main building, which is 385 feet long and 30 feet wide, is well arranged and substantially constructed. The equipment of the plant is as follows: — 1 12-foot rubbing-bed, 1 circular cut-off saw, 1 polishing-machine, 1 surfacing-machine, 25 pneumatic tools, 1 air-compressor, 1 100-horsepower boiler, 1 100-horsepower engine, 1 60-foot derrick, and a blacksmith-shop. The plant is up-to-date, having

¹ May, 1905.



INTERIOR OF THE STOCK-ROOM OF THE GEORGIA MARBLE-FINISHING WORKS, CANTON, GEORGIA.

been constructed only about two years. The company has a large stock-yard, well supplied with stone, and is always able to fill orders on short notice. The Butler Marble and Granite Company employs special designers and experienced workmen, and are thereby enabled to execute first-class work, which finds a ready sale throughout the Southern States. The company at present gives employment to about 50 hands.

CHAPTER X

VARIOUS STYLES OF FINISH

While in the field, specimens of marbles were collected from all the outcrops. The collecting of specimens to form a museum, showing the State's mineral resources, is provided for, in the bill reorganizing the survey; and, as soon as sufficient material has been collected, a special room or rooms in the State capitol will be fitted up, when the marbles, as well as other building-stones, minerals, ores, fossils, etc., obtained within the State will be permanently displayed. The specimens of marble secured for this purpose, where there are no quarries in operation, were ordinary rock specimens, trimmed three by four by one inches; while, at the quarries, eight-inch cubes were secured, each face of which was differently finished, as shown in plate XXVIII.

Figure 1 of this plate shows what is called the "rock-face," and is the rough surface of the stone, as it is taken from the quarry, or only slightly trimmed by a pitching-chisel. The edges of cut blocks are often surrounded by a narrow margin of "drove" work. The "rock-face" finish is used in exterior work, and makes a very attractive building, especially, if the white varieties of the Georgia marble are used. In figures 2 and 3, we have the "pointed-face," differing from the "rock-face," in having the surface of the stone trimmed down by an implement called a point. This style of finish is also largely used in exterior work, two varieties of which are here represented. Figure 4 represents the "tooth-chisel" finish, and is produced by means of a wide chisel, having its edge toothed like a saw. Figure 5 shows the "square-drove" finish, made by a chisel resembling that used in making the tooth-chiseled face, but differing from it, in having its edges smooth, instead of notched. This style of finish is shown as a margin to all the faces here fig-



A GENERAL VIEW OF THE WORKS OF THE BLUE RIDGE MARBLE COMPANY, NELSON, GEORGIA.

ured. The "patent-hammer" finish is produced by the patent hammer,¹ an instrument formed of four, six, eight, or more thin steel plates, fastened securely together, so as to form a single piece, the striking face of which makes, when it comes in contact with the marble, a number of alternating, parallel groves and ridges.² This style of finish gives to the surface of the Georgia marble a snow-white appearance, and is used for exterior work. The polished surface, which cannot be shown by figure, is frequently used on interior decoration, table-tops, tombstones etc. It may be produced, by the use either of oxalic acid or polishing putty. The surface of the stone is first made as smooth as possible, by means of sand or emery and pumice or hone, after which it is rubbed with a woolen cloth, wet with oxalic acid, or charged with polishing putty, either of which produces a very brilliant polish, though the former is not so durable as the latter.

The State Museum is greatly indebted to the Georgia Marble Company and the Southern Marble Company for five eight-inch cubes, furnished by each company, showing the marbles dressed, as above described.

¹ See plate XXVIII, figure 12.

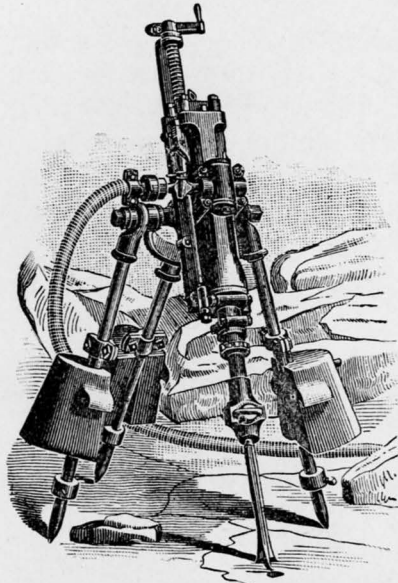
² See plate XXVIII, figure 6.

CHAPTER XI

MACHINES AND IMPLEMENTS USED IN MARBLE- WORKING

The following descriptions of machines and implements, used in working marbles, are taken from the report of the United States National Museum for 1886,¹ with slight changes.

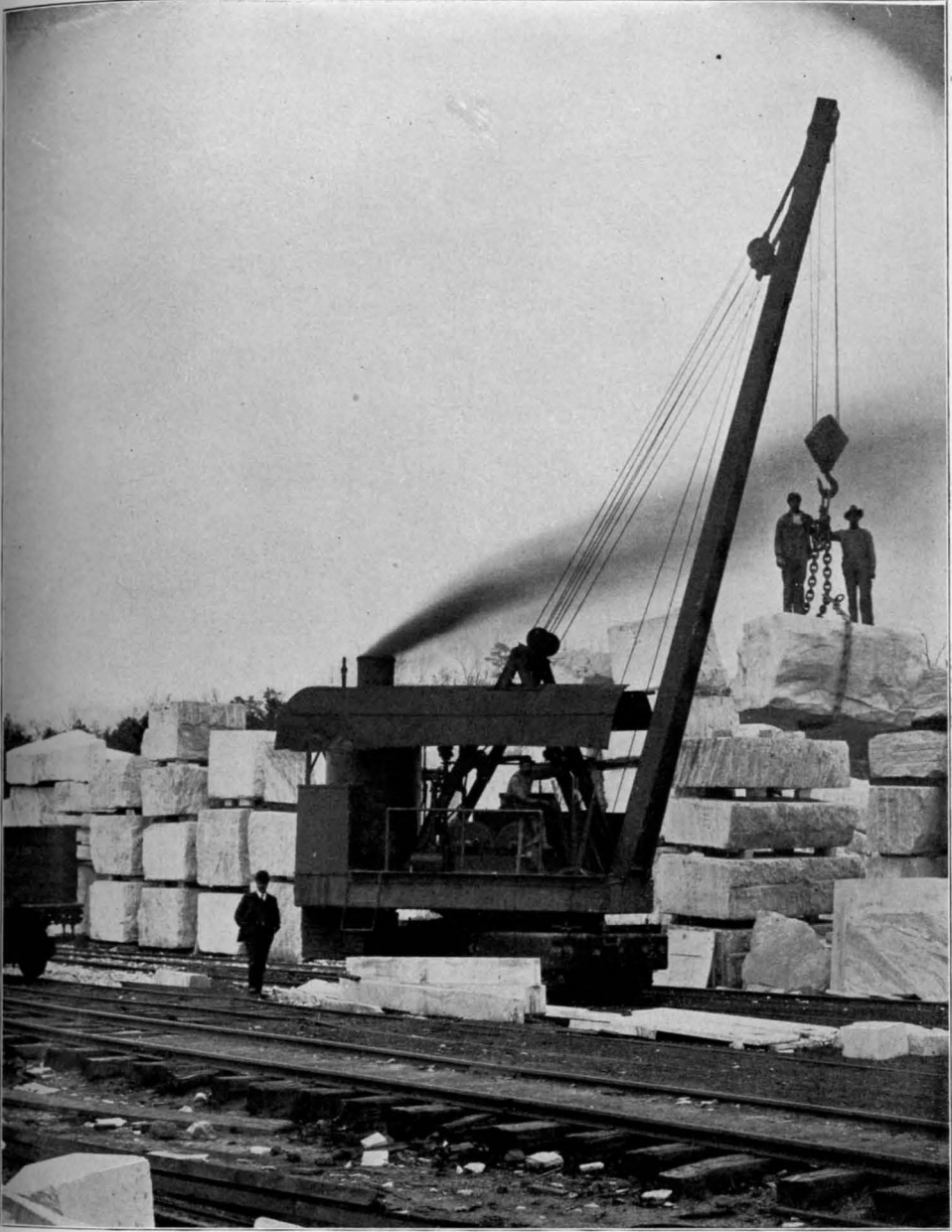
FIG. 1



THE ECLIPSE ROCK DRILL.

Of the many machines, that have, from time to time, been invented for working stone, we can here mention only the principal ones, that are to-day in actual use.

¹ "The collection of Building and Ornamental Stones in the United States National Museum : A Hand-book and Catalogue. By George P. Merrill, Curator of the Department of Lithology and Physical Geology," 1889. As this book is out of print, Dr. Merrill has added much new matter to the original, and it is now published by John Wiley and Sons, New York City, under the name, *Stones for Building and Decoration*.



A VIEW IN THE STOCK-YARD OF THE BLUE RIDGE MARBLE COMPANY, NELSON, GEORGIA, SHOWING THE LOCOMOTIVE CRANE AT WORK.

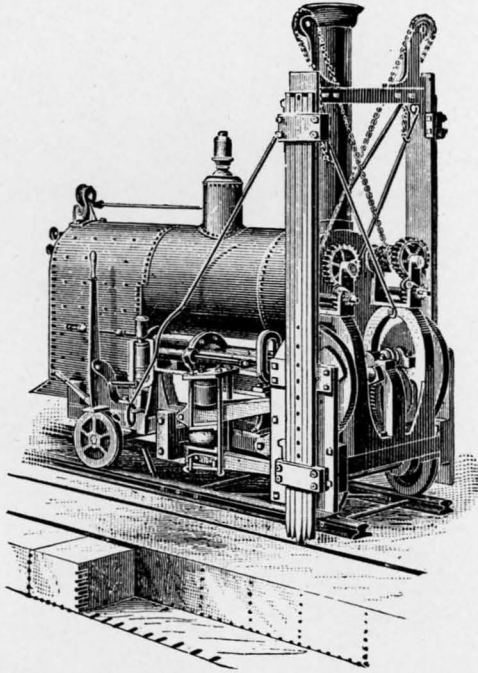
DRILLS.—The old-time method of drilling by means of a flat, pointed drill, called a “jumper,” which is held by one workman, while others strike it alternate blows with heavy hammers, although still in use in many quarries, has been largely superseded by steam-drills of various kinds.

A simple form of the steam-drill, and one now in very general use, is that shown in figure 1. The drill proper is fastened directly to the piston, which can be inclined at any angle, thus fitting it for ordinary quarrying or tunneling. It is driven either by steam or compressed air. A different adaptation of the same principle is employed in channeling and gadding machines, used in getting out dimension stones. The drill and cylinder are attached to the horizontal bar, by means of a clamp, which can be loosened or tightened at will. By this means a dozen or more holes can be cut by simply sliding the drill along the bar, without moving the entire machine.

CHANNELING-MACHINES.—The channeling-machine, shown in figure 2, was invented by *George J. Wardwell* of Rutland, Vt. The first successful machine was built by him in 1863, in connection with the Sutherland Falls Marble Company, and that original machine was at work there constantly, until 1885. These machines are used by the Georgia and Southern Marble Companies, and are in operation at all the important quarries of sandstone, limestone and marble in the country. It is calculated, that over 5,000,000 square feet have been cut by them. The channeler is essentially a locomotive machine, driven by power, usually steam, moving over a steel rail track, which is placed on the quarry-bed. It carries a single-gang drill on one side, or two such drills, one on each side. These are raised and dropped by a lever and crank arrangement. The gang of cutters forming the drill is composed of five steel bars, 7 to 14 feet in length, sharpened at the ends and securely clamped together. Of the five cutters, two have diagonal edges; the other three have their edges transverse. The center of the middle cutter, which is the largest, extends lowest, so that the five form something like a step arrangement away from the center.

The drill, lifted, drops with great force, and rapidly cuts a channel into the rock. The single-gang machine is operated by two men, and the double one by three. As it runs backward and forward over the rock, the machine is reversed without stopping, and, as it goes, the cutters deliver their strokes, it is claimed, at a rate of one hundred and fifty per minute. The machine feeds forward on the track, half an inch at each stroke, cutting half an inch or more at

FIG. 2



THE WARDWELL CHANNELING MACHINE

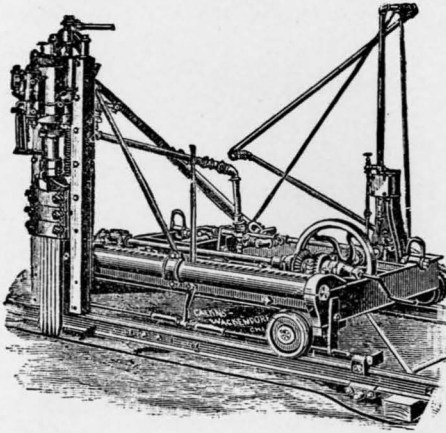
every time of passing. The single machine will cut from 40 to 80 square feet of channel per day in marble or limestone, at a cost of from 5 to 20 cents per square foot. The double machine will do twice the amount of work, in the same time. A good workman would formerly cut from 5 to 10 feet, that is, a groove one foot deep and from 5 to 10 feet long, in one day. For this, he would receive from 25 to 30 cents per foot.



A TRAIN-LOAD OF GEORGIA MARBLE, FROM THE WORKS OF THE BLUE RIDGE MARBLE COMPANY, NELSON, GEORGIA.

Sullivan's Channeling-machines are also used at the Georgia and Southern works. They differ from the Wardwell in several important particulars, prominent among which are these:—1. The cutting-tool is attached rigidly to the piston, so that the stroke is dealt directly by the steam pressure in the cylinder, and without the intervention of any cranks, levers or springs. 2. The cutting-tools are made adjustable to any angle—to the right, left, forward or backward. The machine is thus capable of making transverse and side-hill cuts, and does what is known in quarrying as “cutting out the corners.” 3. It can be used in chambers, where the distance between the floor and the roof is but 6 feet; and it can be used in tunnels and headings. The machine carries five drills in the gang, three straight points and two diagonal ones. These are arranged as seen in the accompanying cut.

FIG. 3



THE SULLIVAN CHANNELING MACHINE

The average capacity, as claimed by the company's circular, is as follows:—

In marble, 80 to 100 square feet of channel, in ten hours.

In sandstone, 150 to 200 square feet of channel, in ten hours.

In limestone, 120 to 150 square feet of channel, in ten hours.

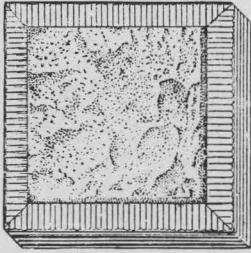
The Ingersoll-Sergeant Channeling-machine is another first-class machine, which is in use at the Piedmont quarry. The principal

points of superiority claimed by the builders of this channeler are its unusually heavy construction of truck-frame, channeler-engine, striking parts, etc.

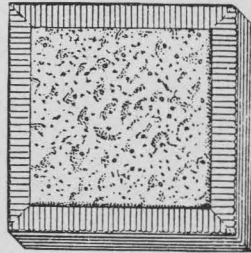
The Diamond Channeling-machine, though not at present used in the Georgia quarries, employs 1 3-4 inch drill-bits, which are attached to the drill-rods of varying lengths, adapted to any required depth of channel up to 9 1-2 feet. The channel may be made open or partly closed, the latter by leaving slight spaces between the holes, to be afterwards chipped out. But the whole operation of a clear cut is made simultaneously by means of an intercutting guide, which answers this purpose very well. The drill can be made to vary in any direction, from perpendicular to a 50° slant, for putting down the tunnel and angle cuts.

GADDERS.—The gadder takes its name from the class of work, for which it is especially designed, and which is known among quarrymen as “gadding.” When the requisite channel-cuts are made about a block of marble to be removed, it is necessary to undercut the block, in order to release it. This is usually accomplished by drilling a series of holes beneath it, and then, by wedges, the block is split from its bed.

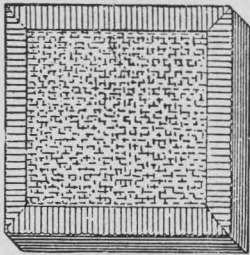
The machine is placed upon a platform on trucks, arranged to run on a track. When adjusted for work, it may be braced by pointed legs. The boring apparatus is attached by a swivel to a perpendicular guide-bar. This guide-bar is secured to the boiler behind it, which forms the main support of the machine. Upon the guide-bar, the boring apparatus may be raised or lowered at will, for the purpose of boring a series of holes in a perpendicular line, if desired. Upon the swivel, the boring-apparatus may be turned, so as to bore in any direction, within the plane of the swivel-plate. At one end of the drill-rod or spindle is the drill-head, armed with carbons, and supplied with small apertures or outlets for water. At the other end of the spindle is attached a hose for supplying water to the drill-head. A rapid revolving movement is communicated to the drill-spindle by the gearing. The speed and feed-movement may be regulated by the operator with reference to the



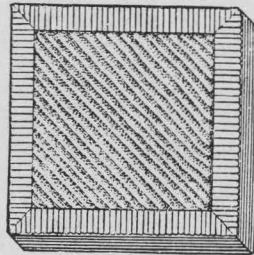
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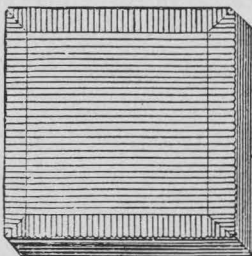
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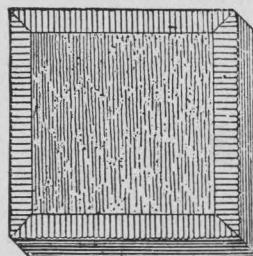
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4



5



6

KINDS OF FINISH.

Fig. 1. Rock Face.

Fig. 4. Tooth-Chiseled.

Figs. 2 and 3. Pointed Face.

Fig. 5. Square Drove.

Fig. 6. Patent Hammered.

hardness or softness, coarseness or fineness of the material to be bored; and the feeding movement may be instantly reversed at pleasure. The machine is so constructed, that the drill-spindle may be removed, and others inserted in the same holder, adjusted to bore in the opposite direction, the boring apparatus being driven by a double-cylinder engine. A continuation of one of the piston-rods through the cylinder forms the plunger to a small pump, placed above the cylinder, which supplies water to the boiler, and forces water through the drill-spindle and head. These jets of water wash out all the borings made, and keep the drill-head from heating. The usual feed of this drill in marble is from four to five inches per minute.

The Ingersoll Gadding Machine is used in the Georgia marble quarries; it is only a special adaptation of the steam-drill. It is claimed, that this machine will "put in holes, close to the bottom of the quarry, in a horizontal position along the bench, into the roof, or perpendicularly into the floor as desired."

GRINDING AND POLISHING MACHINES.—In large works, the grinding and polishing is now generally done by steam power. For flat surfaces, a circular, horizontally revolving iron plate or grating, attached to the lower end of a vertical shaft, with elbow joint, is used; the workman guides it to any portion of the surface he may desire, by means of a handle, the abrading substance being sand or emery. With felt attached to the plate, the same form of machine is also used for polishing. Blocks of such size, as can be handled by the workmen, are usually ground upon horizontal revolving iron beds, some eight or twelve feet in diameter. In making straight or only slightly curved moldings, the form is first carved out with a chisel, and then a plate of cast-iron, fitting as accurately as possible, is made by means of a long arm, to travel back and forth over the stone, with sand or emery, or putty-powder and felt, as the case may be. These are called pendulum-machines. The actual labor is thus greatly reduced, and a higher and more lasting polish obtained, than is possible by hand.

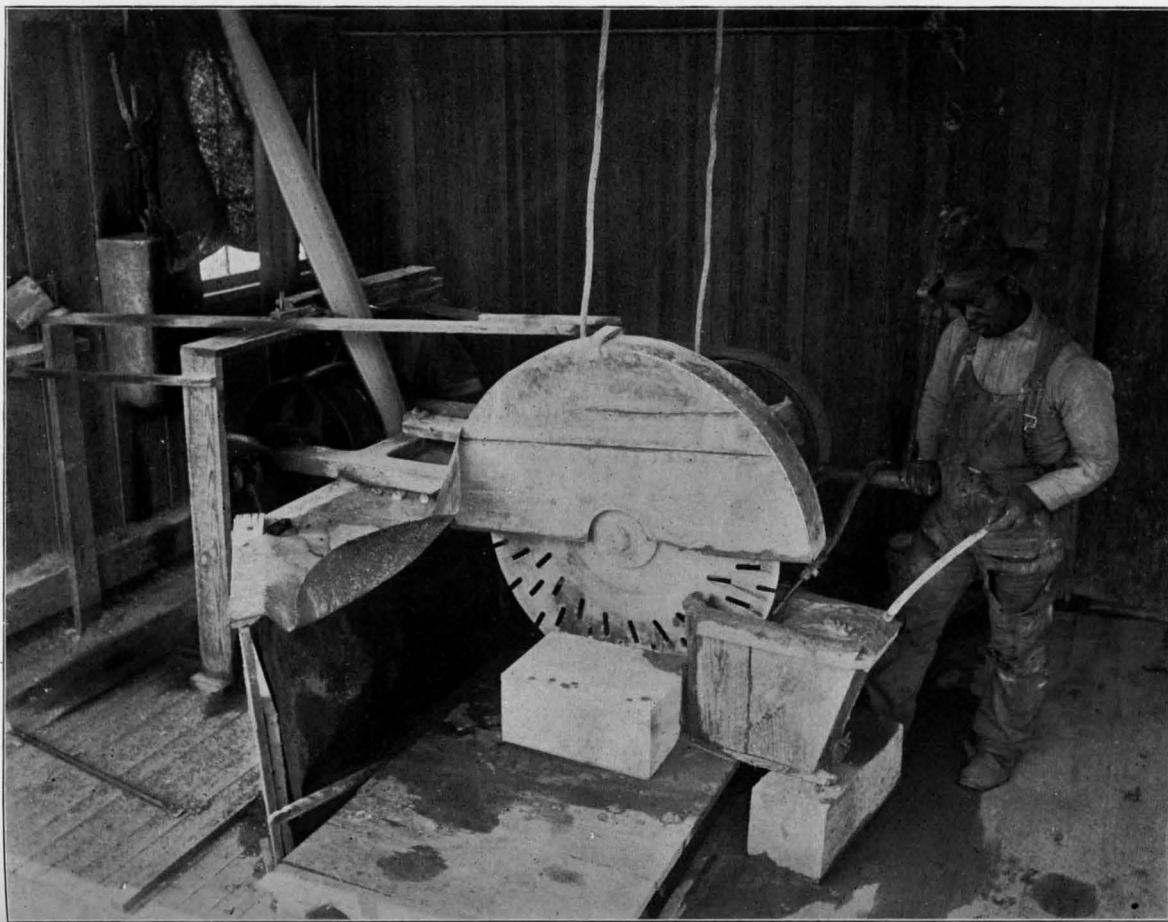
LATHES AND PLANERS.—Lathes are now very generally used,

for turning posts and pillars from soft stone, as well as from granite. In easy working varieties, as sandstone, limestone and marble, the cutting tool is a simple chisel, much like that used in turning metals, and is held in a clamp in the same way. With the softer varieties of stone, a plane surface, sufficiently smooth for flagging, is produced by means of a planing machine, similar to those in use for planing metals, and is operated in the same manner.

MACHINES FOR SAWING.—In sawing marble, the same method, with some modifications, is employed, as was in use according to Professor Seeley, three hundred years before the Christian era. The principal consists simply of a smooth flat blade of soft iron, set in a frame and fed with sharp sand and water. The saws are now frequently set in gangs of a dozen or more in a single frame, and several gangs are sometimes operated by one man, who shovels on the wet sand, as it is needed, while fine streams of water from overhead wash it beneath the blade, as it swings backward and forward in its slowly deepening groove. Some attempts at automatic feeders have been made; but they are not, as yet, in general use.

This method has been found to be inapplicable for cutting granite, owing to the greater hardness of the material. In the last few years, a sand, composed of globules of chilled iron, has been used to good advantage. The great drawback to the use of this material, so far as observed, is the care necessary to avoid staining the stone by rust from the wet globules, during the time the machine is not running. This is done by wetting down the stone and globules in the saw-frame, with a thick solution of lime-water, prior to leaving the saws for the night. Circular saws, with diamond teeth, have been used to some extent; but they have not come into general use, on account of being too expensive.

For sawing circular apertures in the top of a washstand, or getting out tops for small tables, a saw, made of plates of soft iron bent into the form of a cylinder and revolved by a vertical shaft, is used. Sand, emery, or globules of chilled iron constitute the cutting materials, as with the saws just mentioned.



CIRCULAR CUT-OFF SAW IN USE AT THE BUTLER MARBLE AND GRANITE COMPANY'S WORKS,
MARIETTA, GEORGIA.

A recent European invention for sawing stone consists of a twisted cord of steel, made to run around pulleys like a band-saw. The cord is composed of three steel wires loosely twisted together, but stretched tightly over the pulleys, and is made to run at a high rate of speed. The swift successive blows from the ridges of cord, delivered along the narrow line, disintegrate the stone much more rapidly, it is claimed, than the iron blade fed with sand. The usual rate of cutting in blocks of soft limestone is about twenty-four inches an hour, and, in marble, a little more than nine inches an hour. In certain Belgian marble quarries, the saw is said to be used to advantage in cutting the rocks from the quarry-bed. In thus utilizing it, the floor is first cleared, as for channeling-machines, and then, by means of large cylindrical drills, fed with metallic sand, a shaft twenty-seven inches in diameter is cut to the desired depth, and the cores are taken out, as by the common tubular diamond-drill. Two of these holes are sunk at proper distances apart, and guides are set up in them, on which movable frames are placed, carrying pulleys of a diameter somewhat less than that of the holes; over these pulleys the cord-saw is stretched; motion is then imparted to the pulleys by a simple system of transmission, and the saw cuts without interruption, until the bottom of the drill-pit or shaft is reached. A great saving of time and material is claimed for this invention. Although it seems to promise well, none are, as far as is known, in use at present in this country.

THE SAND-BLAST.—The sand-blast has been utilized to some extent, in the work of lettering headstones, and for producing delicate tracings on quartzite. That the process is so little used is due, it is said, to the opposition of the trades-unions, and not to any defect in the process itself.

HAND IMPLEMENTS.—*The Face Hammer*.—This is a heavy square-faced hammer, weighing from fifteen to twenty-five pounds, and is used for roughly shaping the blocks, as they come from the quarry. It is sometimes made with both faces alike, or again with one face flat, and the other drawn out into a cutting edge.¹ The

¹ See figure 10, plate XXX.

cavil differs from it, only in having one face drawn out into a pyramidal point.

The Ax- or Pean-hammer is made with two opposite cutting faces, as seen in figure 13, plate xxx. The edges are sometimes toothed roughly, when it is called the toothed-ax.

*The Patent or Bush-hammer*¹ is made of four, six, eight, ten or more thin blades of steel, bolted together, so as to form a single piece, the striking faces of which are deeply and sharply grooved. This hammer is said to have been invented by Joseph Richards of Quincy, Mass., at some time between the years 1831 and 1840. As constructed, this head was composed of a single piece, instead of several as now. In some works this is called a bush-hammer.

Crandall.—This consists of a bar of malleable iron about two feet in length, and slightly flattened at one end, through which is a slot, three-eighths of an inch wide and three inches long. Through this slot are passed ten double-headed points, of one-fourth of an inch square steel, nine inches long, which are held in place by a key.

*Sledge Hammer.*² — A smooth-faced hammer, weighing from ten to twenty-five pounds, used for striking the drills, in hand-drilling, or in driving large wedges for slitting stone.

*Hand-hammer.*³ — A smooth-faced hammer, with two striking faces, weighing from two to five pounds. It is used for hand-drilling, pointing and chiseling in hard kinds of rocks. It usually has both faces alike.

*Mallet.*⁴ — This is a wooden implement, with a cylindrical head, used in place of the hammer in cutting the soft stones, as marbles and sandstones.

Pick.—An instrument resembling the ordinary pick-axe used in digging, but somewhat shorter and stouter. It is used on soft varieties of stone, for rough dressing or channeling, prior to wedging.

*Pitching Chisel.*⁵ — This is a steel chisel, the cutting face of which is rectangular in outline, and with sharp angles or corners. It is

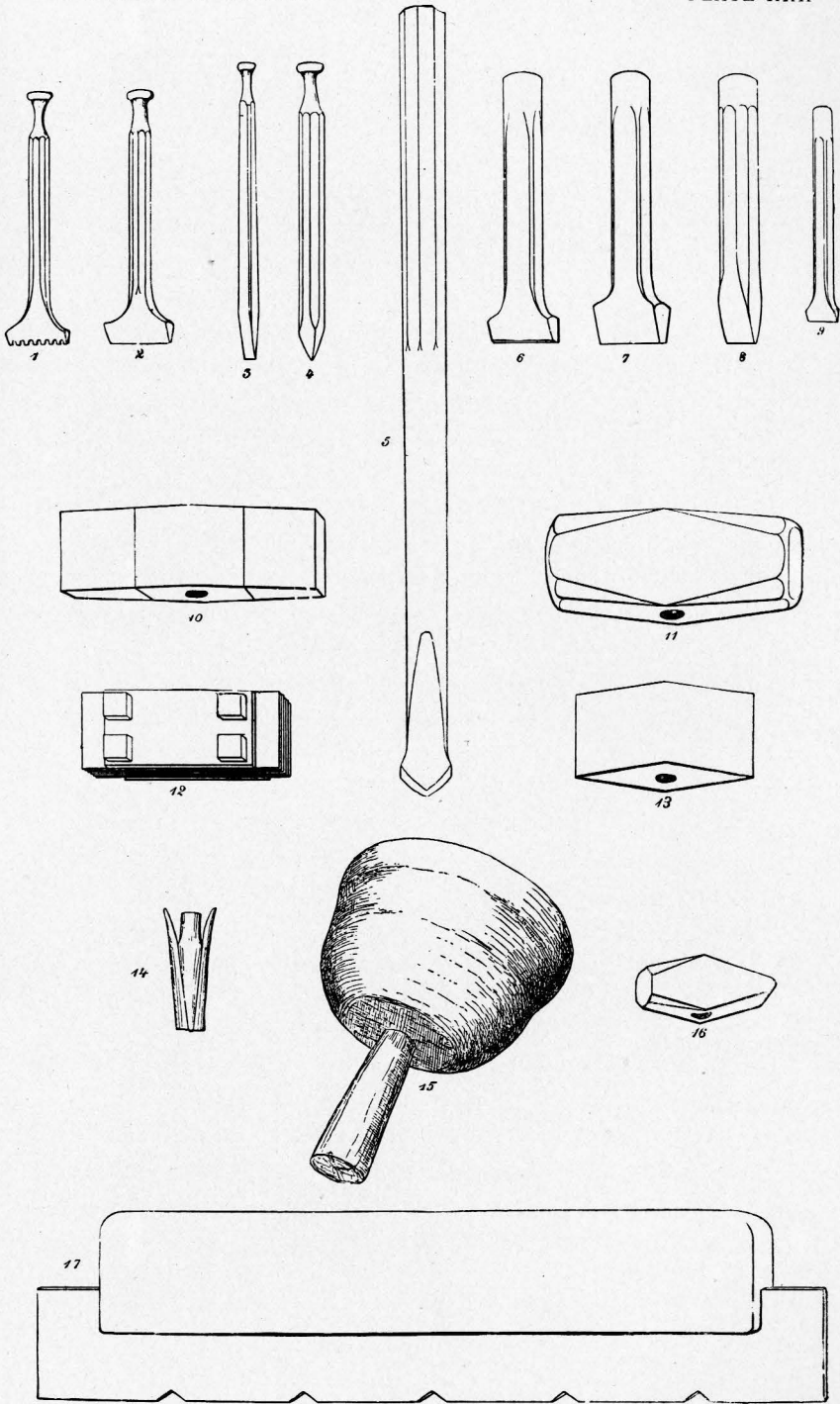
¹ See figure 12, plate XXX.

³ See figure 16, Plate XXX.

² See figure 11, plate XXX.

⁴ See figure 15, plate XXX.

⁵ See figure 7, plate XXX.



TOOLS USED IN STONE-CUTTING.

used for trimming down the edges to a straight line. The *Chipper* is used for similar purposes.

Chisel or Drove.—This is a steel chisel, the cutting edge of which is drawn out wide and thin, as shown in figure 2, plate xxx. It is used, principally, on the soft varieties of rock, in producing what is called “drove-work.”

Splitting Chisel.—A steel chisel, made as shown in figure 8, and used in splitting and general cutting on hard stone like granite. Other forms of chisels, used only on soft stone and driven with a wooden mallet, are shown in figures 3 and 6, plate xxx.

*Tooth Chisel.*¹ — A chisel like the drove-chisel, but with the edges toothed like a saw. It is used, only on soft stones, like marbles and sandstone.

*Point.*² — A steel implement, with the cutting end in the form of a pyramidal point, used in the production of the finish known as “point-work,” and also in the smoothing down of rough surfaces, prior to using the ax or some other tool for fine work. Points for use on hard stone, and driven by the hammer, have the upper end finished as shown in figures 6 and 7, plate xxx.

*Wedges or Plugs.*³ — The steel wedges used vary greatly in size. Those used in the process of splitting, called “plug and feather,” are but two or three inches in length, while those used in quarrying for splitting off large blocks, are often a foot or more long and correspondingly large.

*Hand-Drill.*⁴ — A small drill from eight to fifteen inches in length, held in one hand and driven by the hand-hammer, is used for making holes for “plug and feather” splitting, and for other light work.

*Grub-Saw.*⁵ — A saw for cutting stone by hand. It consists of a plate of soft iron, from a twentieth to a tenth of an inch in thickness, and from six inches to four feet in length; the blade is notched on the lower edge, and fitted with a wooden back, for convenience in handling and to prevent bending. Sand or emery is the cutting material, as with the steam saws.

¹ See figure 1, plate XXX.

² See figure 4, plate XXX.

³ See figure 14, plate XXX.

⁴ See figure 5, plate XXX.

⁵ See figure 17, plate XXX.

CHAPTER XII

PHYSICAL TESTS OF THE GEORGIA MARBLES

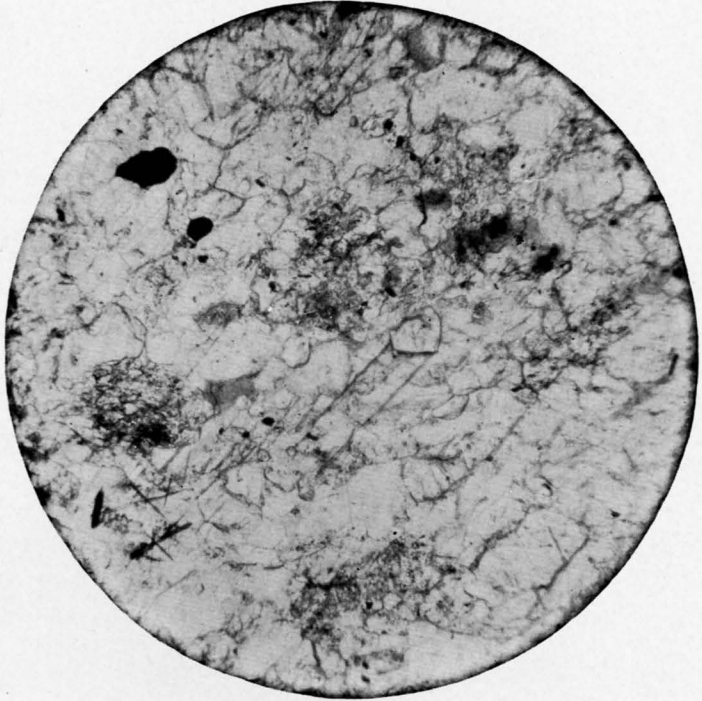
THE MICROSCOPIC STRUCTURE OF MARBLES

Though the use of the microscope in the study of rocks is of recent date, yet it has rendered invaluable aid, in making out the structure and the composition of rocks, which are always the most important points to be considered in selecting a building stone. By this means, the most minute impurities or defects, which might give rise to uneven weathering or to rapid disintegration in a stone, can frequently be readily detected. A chemical analysis gives the ultimate chemical composition of a rock, while a microscopic analysis gives its mineralogical composition, showing in what form the chemical elements are combined, and how different two rocks may be in structure and texture, though nearly alike in chemical composition. Thus, for instance, take two limestone hand-specimens, which closely resemble each other. When subjected to chemical analysis, they are found to be identical in composition; but, on examining them, in thin sections under the microscope, they are seen to be very different in structure, one being phenocrystalline, while the other is cryptocrystalline. By the aid of the microscope, we are also able to follow every phase of crystallization, and to explain many otherwise unknown parts of the history of many of our building stones, and the changes, which they are likely to undergo, when subjected to new conditions.

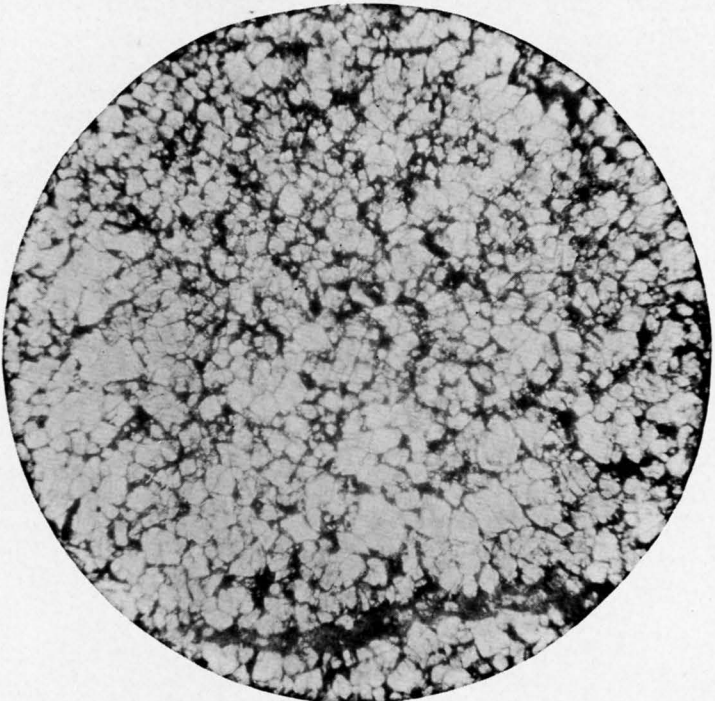
In order to study fragments of rocks under the microscope successfully by transmitted light, it is necessary that they be made so thin, that the darkest colored stone may become at least partly transparent. The manner of preparing thin sections depends mainly on the means at hand for executing the work. When no stone-cutting machine is to be had, thin chips or flakes can usually be broken

from the stone, of the desired shape and thickness, by means of a hammer; but, when it is desired to make a section in some particular direction through a rock, it is essential to have recourse to a machine, in order to get satisfactory results. A number of machines have been devised for this purpose, several of which are said to do very satisfactory work. The one belonging to the laboratory of the Geological Survey of Georgia was devised by the late Professor George H. Williams, of Johns Hopkins University; it is probably one of the best now in use for small laboratories. Slices, about one thirty-second of an inch in thickness, are cut by this machine, by pressing the stone against a rapidly revolving metallic disk, having diamond-dust set in its edge. It is run with a small dynamo, supplied with electricity from a three-cell storage battery. This machine has also attached to it a horizontal grinding disk of copper, on which the slices can be ground to the desired thinness. Having obtained thin slices of the stone, either by use of the section machine, or by detaching thin chips with the hammer, the next process is to prepare them for the microscope. This is done by rubbing down one side of the specimen, until it becomes perfectly flat and smooth, either by grinding it by hand on a flat surface of plate glass, with emery and water, or by using the same abrasive material on the horizontal revolving disk of the section-machine. When the necessary machine is at hand, the latter method is always preferable, on account of the rapidity with which the work can be executed. The chips used in making sections are usually about three-quarters of an inch in diameter; if not of convenient shape to be pressed flat by the finger against the grinding surface, the fragment to be ground must be cemented to a bit of wood, in order to hold it steady before proceeding to rub it down. When the desired flatness and polish have been obtained, and all the dirt and particles of emery have been thoroughly removed from the surface, the next process consists in cementing the smooth surface of the stone to a small piece of plate glass about two inches square and a quarter of an inch thick. The specimen, with its polished face downward, is fastened to the plate

glass by means of Canada balsam, which becomes quite hard, after being heated, and forms a strong union between the smooth surfaces. The slice thus firmly attached to the glass can be easily held in position on the grinding-surface, until it has been reduced to such a degree of tenuity, as to become transparent. It is then transferred to a new glass slide, mounted in Canada balsam, and covered by a thin cover-glass, when it is ready for examination under the microscope. The microphotographs, used in this report, were made by photographing through the microscope, thin sections of marble, prepared as above described. The same magnifying power, which was about fifty diameters, was used in all cases except for the specimen of Etowah marble, where twenty-five diameters was used. The above notes on the preparation of thin rock sections were taken chiefly from Sir Archibald Geikie's work on the *Outlines of Field Geology*.



1



2

I

A microphotograph¹ of marble from G. W. Crain's property, near Canton, Cherokee county, magnified fifty diameters. The section shows very small grains of calcite, through which are irregularly scattered a small amount of foreign substances. Besides mica and magnetite, various minute needles of light colored amphibole (?) may be seen. Some of these impurities occur in sufficiently large grains to be seen with the unaided eye, and give to the surface of the marble, when weathered, a roughened appearance.

2

A microphotograph of dark colored marble, from a quarry near Six Mile Station, Floyd county, magnified fifty diameters. The individual granules of calcium-magnesium carbonate, making up this marble, as shown by the section, are quite small, and are frequently separated from each other, by carbonaceous material, which gives to the stone its dark color.

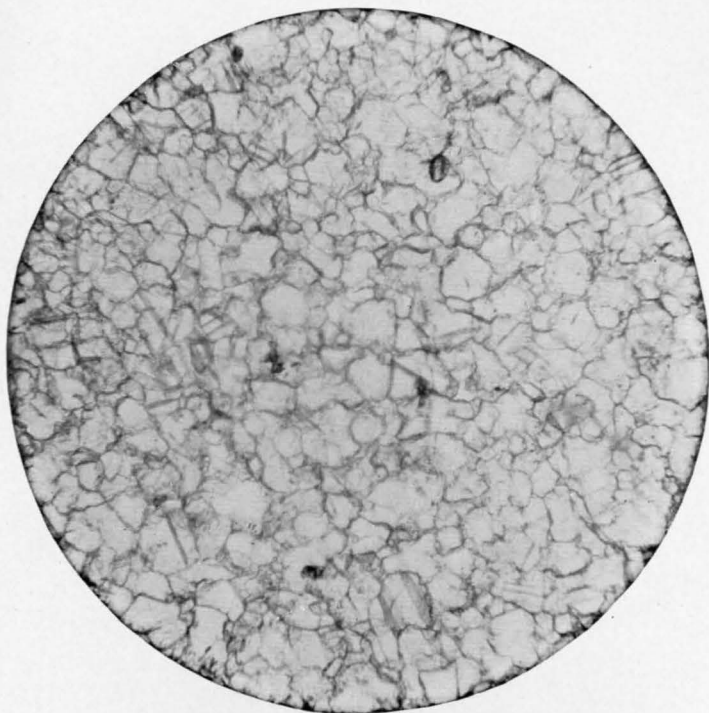
¹ The Survey is under obligations to Professor F. Lamson Scribner, of the Agricultural Department, Washington, D. C., for the use of instruments and for aid, in making the microphotographs here shown.

3

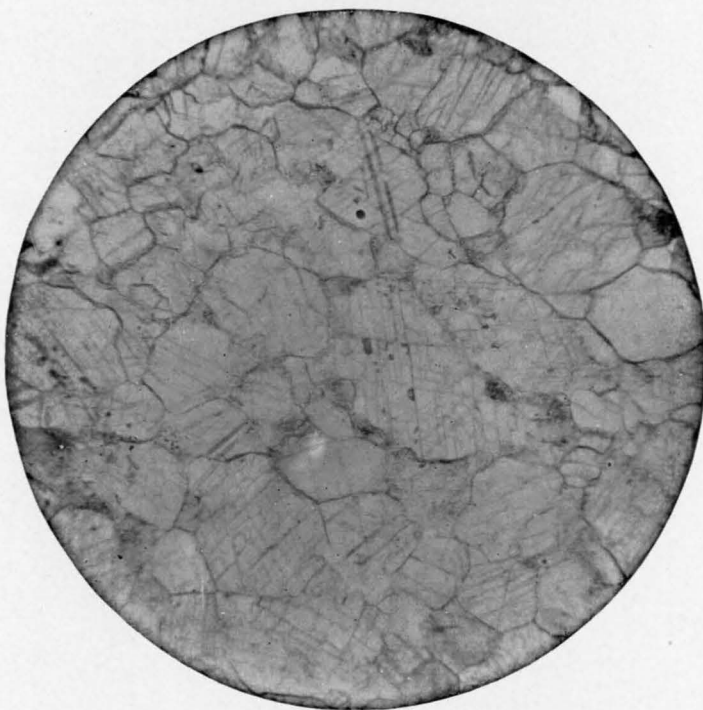
A microphotograph of light colored dolomite marble, from a quarry one mile east of Mineral Bluff, Fannin county, magnified fifty diameters. This is quite fine-grained, and has few impurities.

4

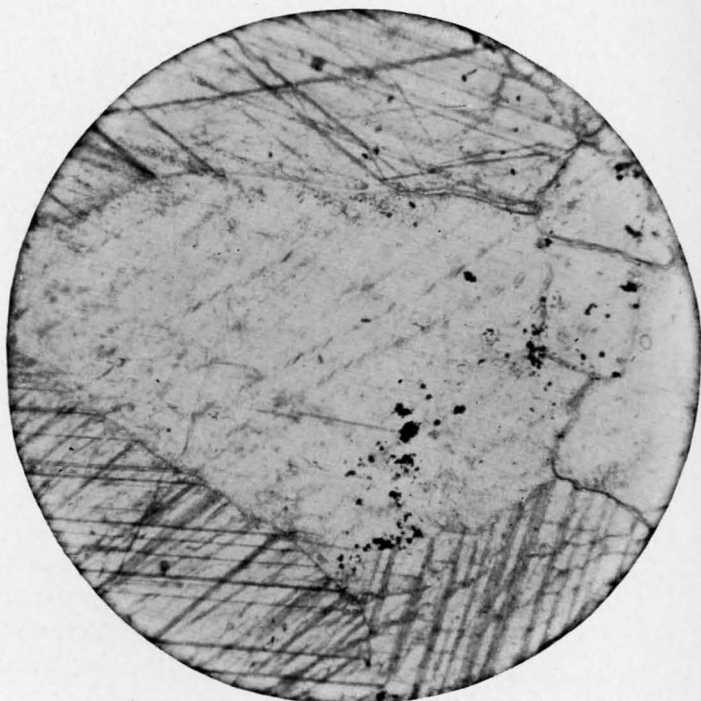
A microphotograph of marble from Marble Bluff, Gilmer county, magnified fifty diameters. A moderately fine-grained marble, with small scales of mica, as inclusions.



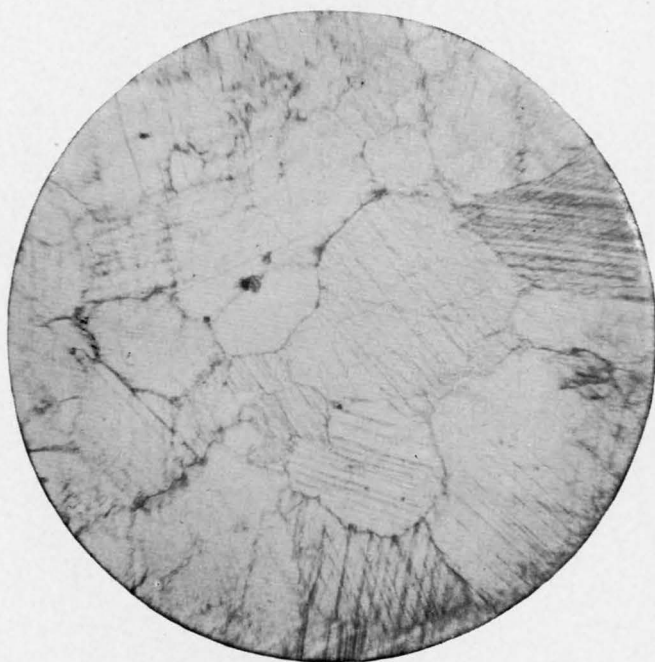
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5

A microphotograph of the Creole marble from the Georgia Marble Company's quarries, Pickens county, magnified fifty diameters. The section shows very large grains of calcite, through which are unevenly distributed minute scales of graphite, that gives to the stone its dark or blue color.

6

A microphotograph of marble from the Etowah quarry, Pickens county, magnified twenty-five diameters. The specimen, from which this section was taken, was of a beautiful flesh color; but this color seems to entirely disappear, when it becomes sufficiently thin to be studied under the microscope. The dark specks near the center of the section are mica, which occurs sometimes quite plentifully along definite lines.

CRUSHING TESTS

The crushing tests were made at the University of Tennessee on an Olsen testing-machine, which has a capacity of 20,000 pounds. Inch cubes were used, or as near that size as could be secured. The upper and the lower compressed surfaces of the cubes were protected in all cases, by means of a dense cardboard about one-sixteenth of an inch in thickness. The object in using these pads was to secure, as near as possible, a uniform degree of pressure on all points of the compressed area. This precaution would have been unnecessary, if the opposite sides had been exactly parallel; but probably in no case was this absolutely true. All the specimens produced, in crushing, a theoretical break; that is, each cube, after being crushed, formed a double cone, whose bases were the original compressed faces of the cube.¹ This break shows the specimens to be sound, and that the weight was distributed equally over the entire surface. The comparative strength per square inch, as given by these tests, is much higher, than that of many of the marbles used as building and ornamental stones in the United States; especially is this true of the Creole and Etowah marbles, from the Georgia company's quarries. Of the twenty-five crushing tests of marbles given in the tenth census report on building-stones of the United States, only five samples surpass these in strength. It will be seen by comparing this table with the one on absorption, that there is an obvious relation between the ultimate strength and the porosity, as shown by the amount of water absorbed, the more porous being the easiest crushed. Both the specific gravity and the weight per cubic foot are high, which shows the stone to be quite dense and free from pores: this is also verified by the absorption tests.

¹ See plate XLIX.



ENTRANCE TO THE CENTURY OFFICE BUILDING, ATLANTA, GEORGIA. THE FIRST FOUR STORIES CONSTRUCTED OF WHITE GEORGIA MARBLE BY THE BLUE RIDGE MARBLE COMPANY, NELSON, GEORGIA.



A SECTION OF THE MONUMENT-CUTTING DEPARTMENT OF THE GEORGIA MARBLE FINISHING WORKS,
CANTON, GEORGIA.

CRUSHING TESTS¹

NAME	QUARRY	Compressed Sur- face in inches	Pounds	Actual crushing load in pounds	Compressive strength per square inch in pounds	Reduced to corre- spond to pressure per sq. in. on 2 in. cubes ² , in lbs. per sq. inch	Specific gravity	Weight per cubic foot in pounds	REMARKS	
Kennesaw	No. 1	Kennesaw.....	.99 x .99	Bed.	10,000	10,204	12,244	.....	Cracked on edge before bursting	
"	" 2	Kennesaw.....	1.00 x 1.00	"	11,400	11,400	13,680	2.717	169.8	Burst suddenly
"	" 3	Kennesaw.....	1.00 x 1.00	"	10,672	10,672	12,806	.....	.....	Burst with explosion
Creole	" 1	Georgia.....	1.00 x 1.00	"	13,900	13,900	16,680	.....	.....	Burst with explosion
"	" 2	Georgia.....	1.00 x 1.00	"	13,100	13,100	15,700	2.763	172.6	Burst with explosion
"	" 3	Georgia.....	1.00 x 1.00	"	13,200	13,200	15,840	.....	.....	Burst with explosion
Etowah	" 1	Georgia.....	1.00 x 1.00	"	13,200	13,200	15,840	.....	.....
"	" 2	Georgia.....	.99 x .99	"	12,000	12,244	14,692	2.707	169.1	
"	" 3	Georgia.....	.99 x .98	"	12,300	12,540	15,048	.....	.....
Southern	" 1	Southern .....	.99 x 1.00	"	11,300	11,414	13,696	.....	.....
"	" 2	Southern .....	.99 x 1.00	"	10,900	11,010	13,212	2.734	171.8	
"	" 3	Southern .....	.98 x 1.00	"	10,800	11,020	13,224	.....	.....

¹The Survey is under obligations to Professor Chas. Ferris of the Engineering Department of the University of Tennessee, for valuable aid rendered in making the crushing and absorption tests.

²General Q. A. Gillmore, in his report on the compressive strength of building stones of the United States, Appendix II, Annual Report of the Chief of Engineers for 1875, determined a general formula for converting the crushing strength of different cubes into each other. In applying this formula for one and two inch cubes, it is found that the crushing weight of the smaller cube should be increased by approximately one-fifth of itself, in order to compare correctly the strength of the two cubes.

CRUSHING TESTS

ABSORPTION TESTS

ABSORPTION TESTS

NAME.	Weight, after drying for 24 hours.	Weight, after remaining in water for 72 hours.	Approximate percentage of absorption.
Kennesaw	45.160 grammes	45.200 grammes	.008 per cent.
Creole	44.820 "	44.835 "	.004 " "
Etowah	42.215 "	42.240 "	.005 " "
Southern, No. 1	46.170 "	46.200 "	.006 " "
Southern, No. 2	44.440 "	44.475 "	.008 " "

In making the absorption tests, one-inch cubes were used. All, except Southern No. 2, which was polished, had sand-rubbed surfaces, and had been lying in the office for about four months. After being exposed to dry air, at a temperature of 212° Fahrenheit, for twenty-four hours, they were carefully weighed and then placed in water at a temperature of about 60° F., for seventy-two hours, and were again weighed. The difference between these weights shows the amount of absorption, which, divided by the weight before immersion, gives the percentage of absorption. The amount of moisture taken up in each case, as shown by the percentage of absorption, was extremely small; especially was this true of the Creole and the Etowah marbles, which absorbed less than one part in two thousand. This test proves, that the stone is practically free from all pores or openings, into which water or any other foreign matter can penetrate, so as to cause disintegration or change of color. By comparing the specimens from the Southern marble quarries, Nos. 1 and 2, it will be seen that the latter, which was polished, absorbed more moisture than the former, which had been only sand-rubbed. This difference in absorption seems to have been entirely due to the physical condition of the surfaces; for, otherwise, the specimens appeared to have been identical in every respect. It will be further noticed, that the marble from the Kennesaw and the Southern quarries, which are located near each other, have a slightly higher percentage of absorption, than the marble (Creole and Etowah) from the Georgia quarries. This is probably accounted for, by the smaller crystalline grains of the latter, which appear to form a somewhat more compact stone than the former.



THE YOUNG MEN'S CHRISTIAN ASSOCIATION BUILDING, COLUMBUS, GEORGIA. BUILT OF GEORGIA MARBLE BY THE BLUE RIDGE MARBLE COMPANY, NELSON, GEORGIA.



A PRIVATE RESIDENCE IN TAMPA, FLORIDA, TRIMMED WITH WHITE GEORGIA MARBLE, CUT AND FURNISHED BY THE BLUE RIDGE MARBLE COMPANY, NELSON, GEORGIA.

CHAPTER XIII

CHEMICAL DISCUSSION OF THE MARBLES OF GEORGIA

BY W. H. EMERSON, PH. D.

Professor of Chemistry, Georgia School of Technology

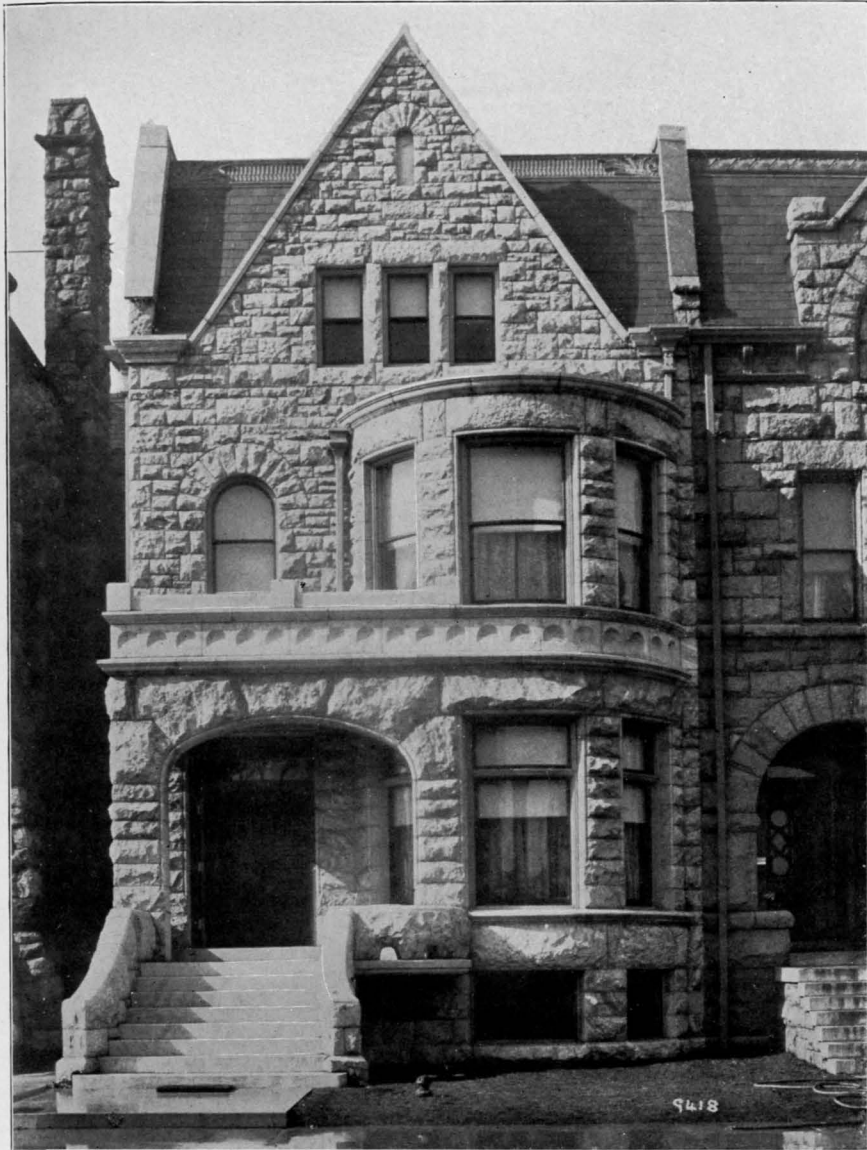
The most valuable properties of marble for structural purposes being strength and durability, for ornamental purposes, color and texture, it would be desirable, in this chapter, to trace the relations between strength, durability, color, texture and chemical composition. Unfortunately, such cannot be done with any degree of fullness or certainty; only a few isolated facts can be noted. The difficulty in establishing such relations is mainly due to the fact, that composition is only of secondary importance, especially in determining strength and durability, these properties being far more dependent on physical structure. Scarcely anything has been done in studying the relations between the properties and structure; so that the effects of composition are complicated by the effects of the practically unknown factor—structure. As has been stated above, marble is essentially calcium-carbonate, a salt having, as its negative element, carbonic acid, one of the weakest acids, being easily displaced from its compounds by most other acids. As a consequence, marble is very sensitive to the action of chemical agents, everywhere present in the atmosphere. The substances normally present in the atmosphere, causing the destruction or weathering of building-stones, are carbonic and nitric acids, oxygen and ammonia; while in the towns and cities this list is augmented by hydrochloric, sulphuric, sulphurous and organic acids, derived from the combustion of coal, chimneys of chemical manufactories, decay of vegetable matter, etc. While marble is more rapidly attacked by chemical

agents than other stones, its power to resist the mechanical agents of weathering, which are generally the most destructive, makes it a comparatively durable stone.

Beside the essential constituent, calcium carbonate, marble always contains some of a large variety of accessory substances, one of which, magnesium carbonate, may vary indefinitely, from calcite, on the one hand, to magnesite, on the other; and, when the proportion is such as to give equal molecules of the two carbonates, the name dolomite is applied. Pure calcium carbonate is easily dissolved in large pieces by cold dilute hydrochloric acid, as is evidenced by the brisk effervescence; while dolomite, under the same circumstances, dissolves so slowly as to produce a scarcely noticeable evolution of gas. In consequence of the greater insolubility, when magnesium carbonate is present, we would expect those marbles, containing more of it, to weather more slowly than those containing less; and this is doubtless true, except where this advantage is counterbalanced by a structure less suited to resist the mechanical agencies of weathering. Dr. G. P. Merrill says:¹ — “The nearer a magnesian limestone approaches a dolomite in constitution, the more durable it is likely to be.” On the other hand, it is likely that, under certain circumstances, the grains of dolomite are liable to show a feeble cohesion, favorable to mechanical weathering. Dana says:— “Grains of dolomite are often but slightly coherent.” Geikie remarks the same. The accompanying table shows, in the case of the Georgia marbles analyzed, that the dolomitic marbles are fine-grained, while the calcite marbles are coarse in texture. Fineness of grain is an advantage, since it is conducive, somewhat, to strength and durability.

As concerns the influence of accessory minerals, it may be said in general, that it is prejudicial to strength. Mica, in particular, when disposed along certain lines, produces a plane of weakness, owing to the little cohesion along its cleavage planes. On the other hand, a tough, fibrous mineral may, if evenly distributed, contribute

¹ Tenth Census; Report on the Building-stones and Statistics of the Quarry Industry.



A RESIDENCE ON PRAIRIE AVENUE, CHICAGO, BUILT OF WHITE MARBLE FROM THE KENNESAW QUARRIES OF THE GEORGIA MARBLE COMPANY, PICKENS COUNTY, GEORGIA.



MINNESOTA STATE CAPITOL, ST. PAUL, MINN. BUILT OF WHITE GEORGIA MARBLE FROM THE AMICALOLA QUARRIES, PICKENS COUNTY, GEORGIA.

somewhat to the strength, acting as a binding material to the granules of calcite.

Extraneous minerals are likewise generally prejudicial to durability. This is sometimes due to the more ready absorption of water, in case the foreign mineral is more porous than marble; the water, on freezing, expands powerfully, disintegrates the stone, and gives an easier access to the water. Again, accessory minerals may cause unequal weathering of the marble, thus producing a roughened surface, more favorable to weathering, and very unsightly. The experiments, given below on artificial weathering, show that the smooth polished surface of No. 1 was acted on more slowly than the unpolished cube of the same stone, presumably due, in part, to the greater surface exposed by the rough specimen, and partly to the fact that minute pores, more or less removed in polishing, facilitate chemical action.

The great variety of colors shown by marbles is due mainly to the presence of accessory minerals. Ferric oxide imparts various shades of red. The pink color of No. 6 is due to a very small amount of ferric oxide, in such a fine state of division, that it remains largely suspended in the fluid, when the marble is dissolved in cold dilute hydrochloric acid, a part of it passing through the paper, on filtering. The reddish-brown color of No. 8 is likewise due to ferric oxide in larger quantity, and not so finely divided. Manganese and cobalt may also produce pinkish shades. Iron, when present in the ferrous state in considerable quantity, produces color, varying from light to dark green. The hydrated iron oxides produce a yellowish brown color. The presence of ferrous carbonate or of pyrite causes the marble to stain yellowish-brown, on weathering, due to the fact, that the compounds named alter readily to a hydrated iron oxide. This staining, in some cases, is said to produce a very pleasing effect.

The various silicates present will impart to marble their characteristic colors. Organic matter frequently produces a black color, as in marble No. 10, which turns white on heating, the organic matter

being decomposed and driven off. Graphite likewise produces a black color, the black portions of No. 3 ("Creole") being nearly altogether due to graphite. The black color due to this mineral does not disappear on heating, as it is only very slowly oxidized in the air.

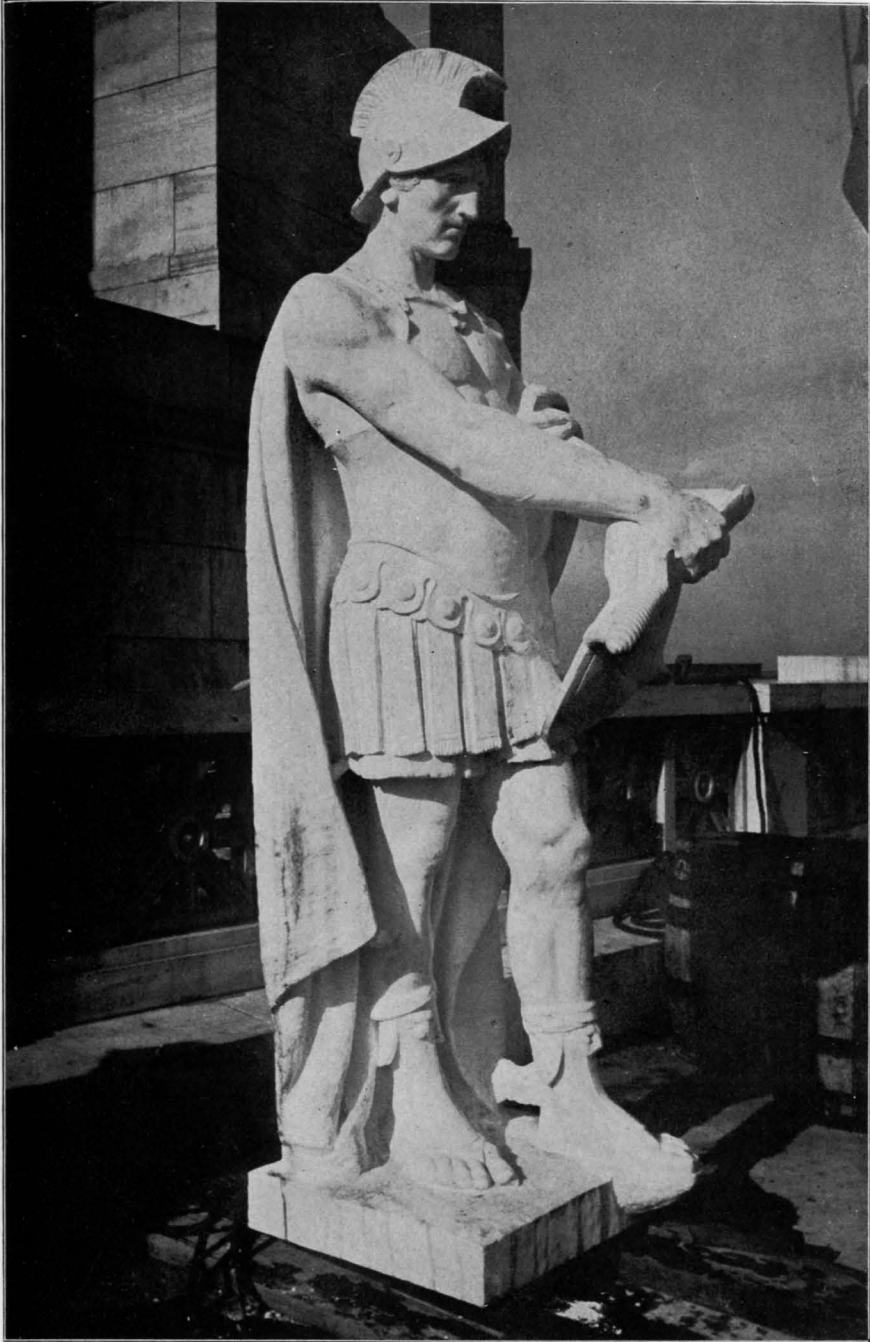
As an experiment to determine the coloring matter in the Creole marble, a fragment was placed in dilute hydrochloric acid and allowed to stand, until all the calcium carbonate was dissolved. There remained only a tuft of foliated graphite. Other minerals, such as black hornblende and black mica, occur in this marble somewhat sparingly; but graphite seems to be the mineral, which gives the marble its mottled appearance. The same is probably true of the Etowah marble, which occurs close to the Creole.

These various colored minerals, present in varying amounts, are variously distributed, and give rise to an almost endless variety of colors, shades and patterns in the different marbles.

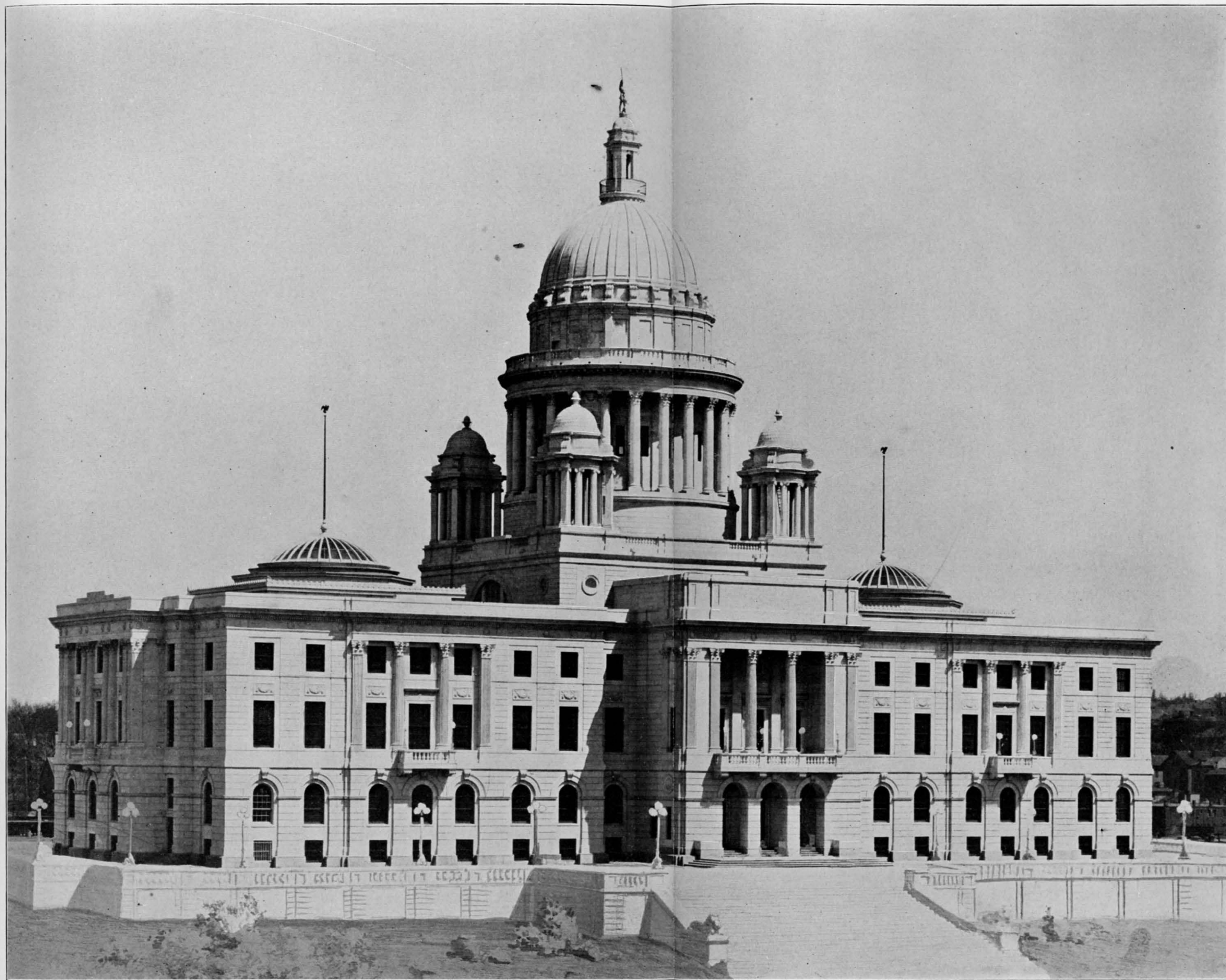
The column in the accompanying table, headed "Insoluble Siliceous Matter," includes all substances insoluble in hydrochloric acid, mainly silicates and silica, as well as silica from any decomposed silicates.

"Loss on Ignition" is mainly carbon dioxide and water; the latter was determined in three or four cases, after drying at 105° to 110° C., and was found to be present to the extent of from .3 to .5 per cent. The amount of iron and organic matter was too small to seriously influence the loss on ignition. The iron of No. 8 is mainly ferric oxide, which is not modified by igniting.

It is noticeable that, even if all the loss is reckoned as carbon dioxide, there is not sufficient to combine with the calcium and magnesium oxides. This was not due to the oxides being partly in combination with other acids, as these were not present in sufficient quantity. It is certainly partly due to the difficulty of weighing calcium oxide, in which form the calcium was determined. When freshly ignited, it increases quite rapidly in weight, in the desiccator, over concentrated sulphuric acid. However, it seems hardly prob-



AN ORNAMENTAL STATUE ON THE MINNESOTA STATE CAPITOL,
CARVED FROM WHITE MARBLE FROM AMICALOLA QUARRY
NO. 1, PICKENS COUNTY, GEORGIA.



THE RHODE ISLAND STATE CAPITOL, PROVIDENCE, RHODE ISLAND.
BUILT OF WHITE MARBLE, FROM THE QUARRIES OF THE SOUTHERN MARBLE COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.

able, that this error would be large enough to account for the whole excess.

The following artificial weathering tests were made on unpolished cubes of Nos. 1, 3 and 6 and a polished cube of No. 1. They were suspended for several days in an atmosphere of hydrochloric, sulphurous and carbonic acids:—

	Original Weight	Final Weight	Loss
No. 1 Polished	45.0868 grammes	44.9337 grammes	.1531 grammes
No. 1 Unpolished	45.9492 grammes	45.7793 grammes	.1699 grammes
No. 3 Unpolished	44.2569 grammes	44.1240 grammes	.1329 grammes
No. 6 Unpolished	42.1369 grammes	41.9943 grammes	.1426 grammes

It is noticeable that the unpolished cube of No. 1 was dissolved with considerably more readiness than the polished.

CHEMICAL ANALYSES

Marbles	Calcium Oxide	Magnesium Oxide	Ferric Oxide and Alumina	Insoluble Siliceous Matter	Loss on Ignition	Total
No. 1	54.06%	.90%	.10%	2.12%	42.86%	100.04%
No. 2	32.73	19.37	.35	.73	46.58	99.76
No. 3	55.00	1.12	.15	.35	44.16	100.76
No. 4	31.53	21.30	.24	.10	47.26	100.43
No. 5	31.61	21.06	.78	1.01	46.49	100.95
No. 6	54.41	.75	.32	1.62	43.13	100.23
No. 7	54.67	1.01	.42	.76	43.49	100.35
No. 8	52.77	.82	3.28	1.43	41.85	100.15
No. 9	24.07	17.24	.43	21.76	37.08	100.58
No. 10	30.42	19.86	.91	4.23	{ Undeter- mined. }	. . . . .
No. 11	31.89	19.64	.74	1.73		

- No. 1 A coarsely crystalline, white marble, from the Cherokee quarry (Georgia Marble Company), Pickens county.
- No. 2 A white, fine-grained marble, from J. P. Harrison's quarry, two miles east of Jasper.
- No. 3 A coarse-grained, black-and-white mottled marble "Creole," of the Georgia quarries.
- No. 4 A fine-grained, gray marble, from the Dickey property.
- No. 5 A fine-grained, bluish-gray marble, from the Holt property.
- No. 6 A coarse-grained flesh-colored marble, "Etowah," of the Georgia quarries.
- No. 7 A coarse-grained, gray marble, from the Eslinger farm.
- No. 8 A coarse-grained, brown marble, from the Hoskins farm.
- No. 9 A fine-grained, light-gray marble from the White property.
- No. 10 A fine-grained black marble from Six Mile Station.
- No. 11 A fine-grained white marble, from Fannin county.

CHAPTER XIV

USES OF GEORGIA MARBLES

Since the first edition of this report, issued from the press in 1894, the value of the product of the Georgia quarries has increased three-fold. Prior to 1891, the use of the Georgia marble was confined to interior finish and monumental stock; but in that year, facilities for handling exterior work was added, and the first building job undertaken was the marble work on the first and second stories of the Equitable Building, Atlanta. Hardly had this building been completed, when work was commenced on the United States Post-office and Custom House, Jacksonville, Fla., the Grand Opera House, Atlanta, and St. James Episcopal Church, Knoxville, Tenn. The construction of the last named building was quite a triumph for Georgia marble, as it is located in the very midst of the extensive marble quarries of East Tennessee.

Subsequent to the first edition of this report, the following is a list of some of the most important buildings constructed wholly or in part of the Georgia marble in the different States of the Union:—The Corcoran Art Gallery, Washington, D. C., exterior and interior; State Mutual Life Assurance Company's building, Worcester, Mass.; Rhode Island State Capitol, Providence, R. I.; Minnesota State Capitol, St. Paul, Minn.; Century Office Building, St. Louis, Mo., exterior; State Savings Bank, Detroit, Mich.; Carnegie Public Library, Atlanta, Ga.; Industrial Institute, Providence, R. I.; Arcade Building, Buffalo, N. Y.; Jewish Temple, Cleveland, O.; Michigan Central Depot, Detroit, Mich.; E. C. Nichols' Mausoleum, Battle Creek, Mich.; Hannah & Dixon's Resort, Kansas City, Mo.; Post-office buildings at Texarkana, Ark., Fort Worth and Brownsville, Texas, Alexandria, La., and Augusta, Ga.; Court Houses, Stephenville and Dallas, Texas; Ling Building, Sherman,



CARVED CAPITOLS FOR COLUMNS OF WHITE MARBLE, RHODE ISLAND STATE CAPITOL, FROM THE QUARRIES OF THE SOUTHERN MARBLE COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.



ORNAMENTAL WORK ON THE RHODE ISLAND STATE CAPITOL, CARVED FROM WHITE MARBLE FROM THE QUARRIES OF THE SOUTHERN MARBLE COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.

Texas; Oriental Artesian Baths, Dallas, Texas; marble work in the Wellington Hotel, Chicago, Ill.; the Candler Building, Atlanta, exterior of the first four stories, and interior finish of all stories; the Mercantile Exchange Bank, Jacksonville, Fla.; United States Post-office, Anderson, Ala.; the Stock Exchange, New York City; the Royal Insurance Company's Building, Broadway, New York City; Office Building for the House of Representatives, Washington, D. C.; Municipal Building of Washington, D. C.; First National Bank Building, Pensacola, Fla.; Montgomery, Ward & Co., Chicago, Ill., exterior; Electric and Gas Building, Atlanta, Ga., interior; Post-office, Tampa, Fla., exterior; Post-office, Savannah, Ga., exterior; Metropolitan National Bank, Washington, D. C., exterior; Bank of Montreal, Winnepeg, Manitoba, exterior; Royal Bank of Canada, Montreal, Canada, exterior and interior; Girard Trust and Banking Co., Philadelphia, Penn., exterior and interior; Mechanics' National Bank, Baltimore, Md., exterior; Century Office Building, Atlanta, interior and exterior of first three stories; Fourth National Bank, Atlanta, Ga., interior and exterior first three stores; Piedmont Hotel, Atlanta, Ga., interior; Louisville & Nashville Passenger Station, Louisville, Ky., interior; Louisville & Nashville Office Building, Louisville, Ky., interior; Terminal Station, Atlanta, Ga., interior; Kentucky State Capitol, Frankfort, Ky., interior and eight elaborate arches for rotunda; Wilson Building, Dallas, Texas, interior; Southern Bell Telephone and Telegraph Co., Richmond, Va., interior; Subway stations, New York City, interior; Young Men's Christian Association Building, Columbus, Ga.; Shenandoah Valley National Bank, Winchester, Va.; Northwestern National Bank, St. Paul, Minn.; Hotel Dieu, Chicago, Ill.; Frear Building, Troy, N. Y.; Illinois State Memorial (\$225,000), Vicksburg, Miss.; Annex to State Capitol, Montgomery, Ala., exterior and interior; New Young Men's Christian Association, Montgomery, Ala.; Marion Hotel, Little Rock, Ark., interior finish; State Capitol, Little Rock, Ark., interior finish, main entrance; Saunders Building, Fort Worth, Tex.; Sanguinet Apartment House, Fort Worth, Tex.; Huntington County

Court House, Huntington, Indiana, interior finish; Carolina Trust Building, Columbia, S. C.; Early County Court House, Blakely, Ga.; Baptist Church, Marietta, Ga.; Germania Bank, Savannah, Ga.; Post-office, Macon, Ga.; First Baptist Church, Newnan, Ga.

The above list of buildings, in which the Georgia Marble has been used, is by no means complete; however, it is sufficient to show the wide-spread distribution of the stone throughout the country. It will be noticed that the greater part of the buildings mentioned are located at distant points. In other words, the stone is widely distributed from the Atlantic to the Pacific and from the Canadian to the Mexican boundaries. There has probably been no building stone in this country, in recent years, which has gained such a wide-spread use and given such universal satisfaction as Georgia marble.

The growth of the use of Georgia marble has been equally as phenomenal in monumental work. The last report on the mineral statistics of the United States, by the U. S. Geological Survey, shows that in 1905, Georgia produced \$275,000 worth of rough marble for monumental purposes, which valuation, omitting Vermont, is more than four times as much as the combined valuation of the monumental marble of all of the other States. This monumental product has an extensive sale, not only in the South, but also throughout the North and West. Moreover, the stone has an extensive use for interior decoration. It is especially suited for wainscoting and other interior finish, where, often by the selection of twin slabs of like color, quite remarkable artistic effects can be secured.¹ A panel of four slabs of Creole Marble thus matched, on exhibition at the World's Fair at St. Louis, was universally admired.

As a building marble, the Georgia stone has but few, if any, equals in this country. Its purity and great strength, together with its extremely low absorption properties, fit it for all classes of exterior work, and at the same time, even in the most rigid climate, gives it a lasting property, surpassed by but few building stones. The color of the stone, which is due principally to the presence of

¹ See plate I.I.



THE CARNEGIE PUBLIC LIBRARY, ATLANTA, GEORGIA. BUILT OF WHITE MARBLE FROM THE QUARRIES OF THE SOUTHERN MARBLE COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.



A VIEW OF A PART OF THE CITY OF WORCESTER, MASSACHUSETTS, SHOWING THE OFFICE BUILDING OF THE STATE MUTUAL LIFE ASSURANCE COMPANY, BOTH THE INTERIOR AND EXTERIOR OF WHITE MARBLE FROM THE QUARRIES OF THE SOUTHERN MARBLE COMPANY, MARBLE HILL,

iron oxide and graphite, minerals but little affected by atmospheric or organic agencies, is as unchangeable as the marble itself. Tombstones, after an exposure of half-a-century, show the same distinct contrast in color as the fresh quarried stone.

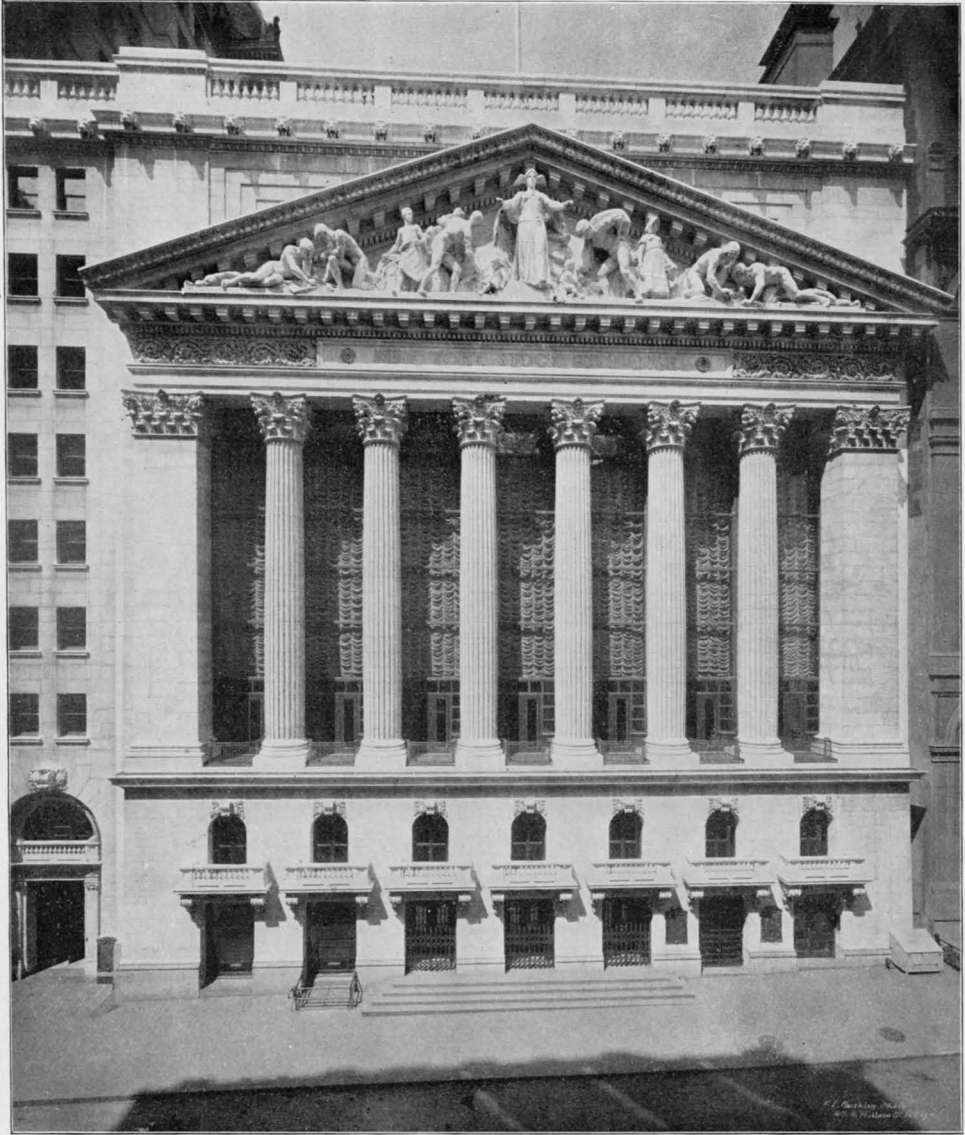
In addition to building, interior finish and monumental uses, the Georgia marble is also used to a limited extent for fluxing and for the manufacture of carbonic acid and magnesium sulphate (Epsom Salts). For the latter purpose, only that marble is used, which runs high in magnesia.

CHAPTER XV

SERPENTINE

The only deposit of serpentine, so far worked in Georgia, occurs at the Verd Antique Marble Quarry in Cherokee County, about two miles southwest of Holly Springs. The quarry is located on a hill-slope in the southwest corner of *land-lot No. 444, 15th district*, near the head of one of the small tributaries of Blanket creek, in a rather hilly, broken section, locally known as Wild Cat district.

Prior to the quarrying of the stone for interior finish and decorative purposes, the property was worked in a small way for talc, a mineral which originally seemed to have been more or less abundant near the contact of the serpentine with the enclosing schist. The first stone quarried for the trade was taken out some 15 or 18 years ago by the American Marble Company, which at that time owned and operated the large marble mill at Marietta, now known as the Kennesaw Marble Works. The American Marble Company operated the quarry only for a short time, when the property was leased to the Verd Antique Marble Company, of Chicago, for a term of 50 years. The last named company which has now been in possession of the property about 9 years, and which has operated the quarry at irregular intervals during this period, is at present quarrying and shipping about 1,200 cubic feet of stone per month. The dimensions of the quarry, from which the stone has been taken by means of the channeler and the gadder, is 80 x 41 feet with an average depth of about 50 feet. The quarrying plant is small, consisting of one good sized boiler for furnishing power, two channelers, a gadder, a 50-foot derrick, a tram car, and a blacksmith shop together with various accessories used in the quarrying industry. The company also owns a tram road-way, about one mile long, connecting the quarry with the main line of the Louisville & Nashville R. R., at a point near Holly Springs.



FACADE OF THE NEW YORK STOCK EXCHANGE BUILDING, CONSTRUCTED OF
WHITE MARBLE FROM THE QUARRIES OF THE SOUTHERN MARBLE
COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.



After a Drawing From a Photograph.

THE STATE SAVINGS BANK, DETROIT, MICHIGAN. BUILT OF WHITE MARBLE FROM THE QUARRIES OF THE SOUTHERN MARBLE COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.

THE EXTENT AND MODE OF OCCURRENCE OF THE STONE

The extent of the deposit is limited to a small area not over 600 feet in length, and with a maximum width of not over 150 feet. In shape it is roughly lenticular being widest near the center and decreasing gradually in width towards either end. Its form suggests an intrusion which has forced its way upward through the schist, the surrounding country rock. The weathered outcrops with their rugged and irregular surfaces form large masses, projecting in places 10 feet or more above the general ground level. Occasionally, the outcroppings have a slight tendency to become schistose, especially on the weathered surfaces near the line of contact with the mica-schist.

STRUCTURE AND PHYSICAL CHARACTERS.

With the exception of the slight tendency to schistosity, above referred to, the stone is distinctly massive, breaking as readily in one direction as another; but, at the same time, the stone is by no means uniform in structure or in mineral composition. One of the most striking physical characters of the serpentine is the veined condition which greatly adds to its beauty. These veins, which are always present, vary in size from a mere microscopic line to a half-inch or so in width, and are often so arranged as to form a complete network. In addition to these smaller veins, there are also present, large veins frequently four or five inches in width, and occasionally several feet in length. The latter are sometimes open, and seriously interfere in quarrying stones of large size, while the former are always closed. The origin of the two systems of veins appear to be entirely different, the larger being due apparently to rock movement, and the other to cleavage lines of the original minerals. The vein fillings in the two different systems are also different. In the larger veins, the filling, which is usually of a light color, consists mainly of ferruginous dolomite and talc, while in the smaller veins the filling appears to be mainly a dark greenish serpentine containing numerous granules of magnetite. The main mass of the stone, which fills the meshes between the individual veins, is chiefly pyroxenite

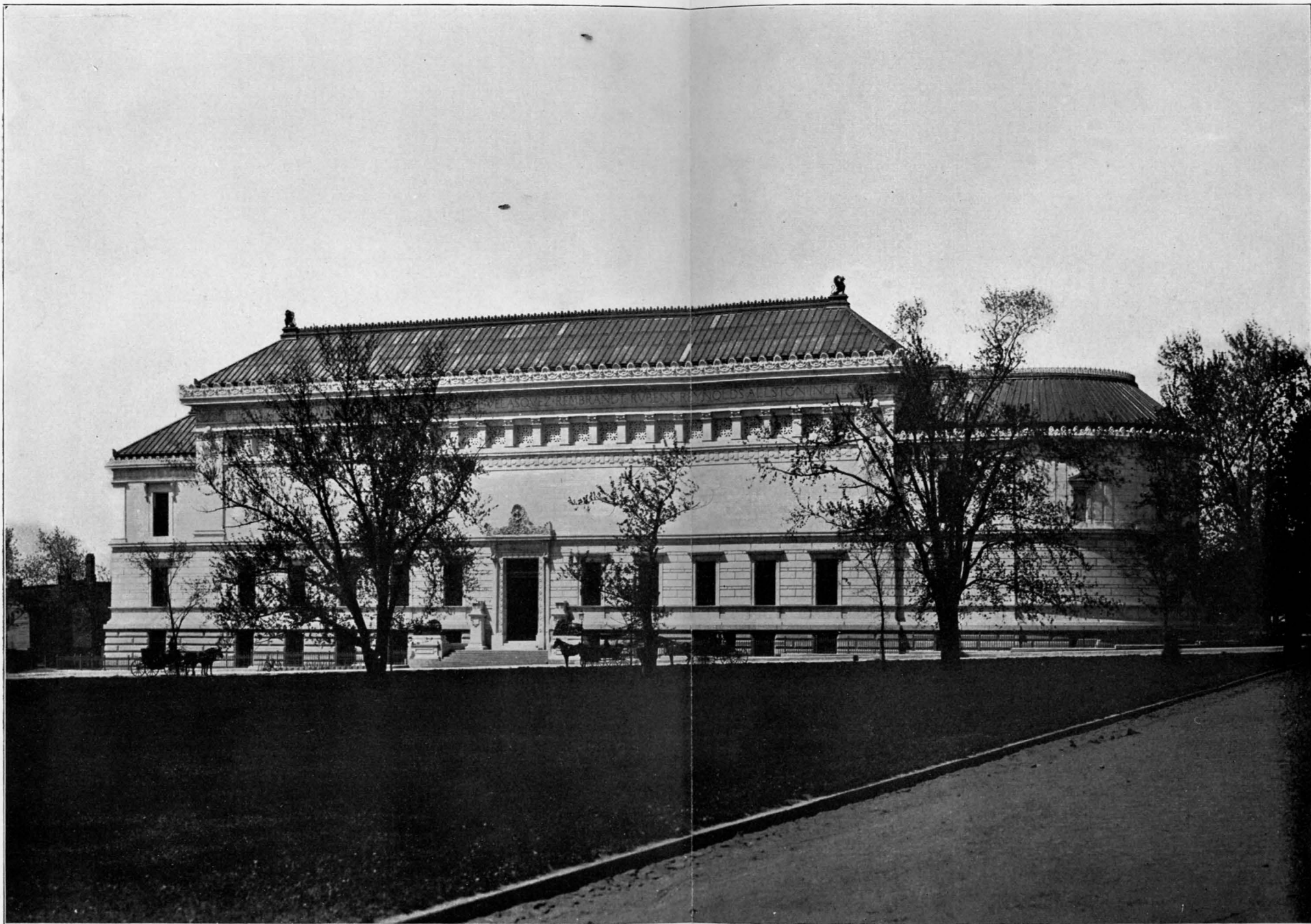
with hornblende, which minerals give to the stone a greenish gray color, often splotched with black. The polished stone less often shows irregularly distributed over its surface small crystals of pyrites, which, upon weathering, produces a brownish iron stain. As this stone is used altogether for interior finish, it is not subject to weathering when in use.

THE USES OF THE STONE

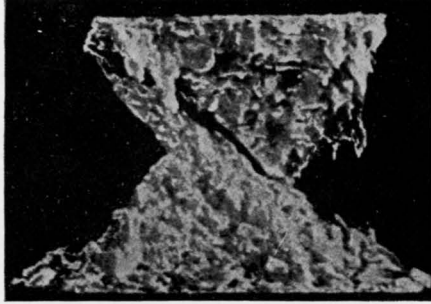
The stone is used almost exclusively for interior finish and decorations. It is especially well adapted for stairways, corridors, mantels and pedestals for statuary. A good example of the pleasing effect of the stone for interior finish may be seen in the entrance of the corridors of the Prudential Building and in the smoking room at the Terminal Station, Atlanta. The stone is also used for a like purpose in some of the large buildings in Chicago, New York and Boston. The cost of quarrying, due chiefly to the unsound condition of the stone, makes the Georgia serpentine so expensive, that, so far, it has not had very extensive use. The increase of soundness, however, with the depth, seems to make the future outlook for the stone more promising.

OTHER DEPOSITS

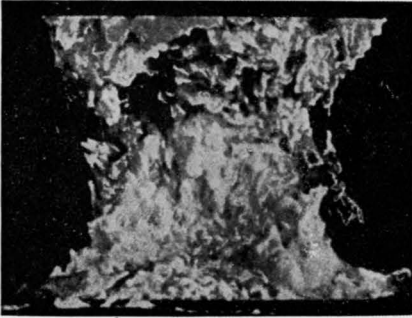
Another deposit of serpentine, quite similar to the stone at the Verd Antique Marble Company's quarry, is to be seen on Frank Haws' property, *lot 567, 15th district*, two miles southwest of the Verd Antique quarry. The outcropping here is only about 150 feet long and 50 feet wide at its widest point. Like the deposit at the Verd Antique Marble Company's quarry, it is lens shaped and is surrounded on all sides by mica-schist. It has likewise been worked along its contact with the schist for talc; but no effort has been made to work it for ornamental stone, or for other purposes. The stone appears to be more fissured, less sound, and of a somewhat lighter color than the stone at the Verd Antique Marble Company's quarry. The small size of the quarry and the unsound condition of the stone would seem to detract from its commercial importance.



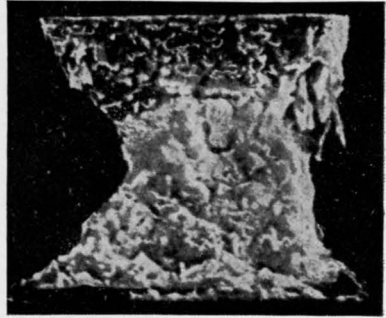
THE CORCORAN GALLERY OF ART, WASHINGTON, D. C., BUILT OF WHITE MARBLE FROM THE QUARRIES OF THE SOUTHERN MARBLE COMPANY, MARBLE HILL, PICKENS COUNTY, GEORGIA.



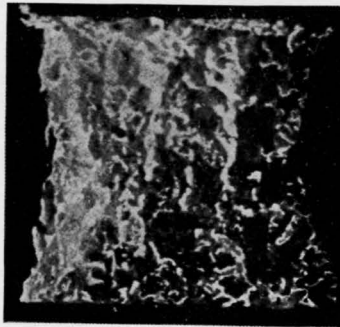
1



2



3



4

ONE-INCH CUBES OF MARBLE, AFTER HAVING BEEN SUBMITTED
TO CRUSHING TESTS,

No. 1.	Creole,	crushing strength,	13,200 lbs.
" 2.	Kennesaw,	" "	10,000 "
" 3.	Etowah,	" "	13,200 "
" 4.	Southern,	" "	10,900 "

HENRY COLE PROPERTY

The Cole property, *lot 490, 15th district*, is located about one mile southeast of the Verd Antique Marble Company's quarry, and within about half-a-mile of the Louisville & Nashville R. R. The exposure occurs only a few hundred yards from Mr. Cole's residence. It consists of a dark colored massive rock, chiefly in the form of boulders, covering something like half an acre. The rock is locally considered to be similar to the stone quarried at the Verd Antique Marble Company's quarry; but a close examination shows it to be different not only in mineral composition, but also in structure and its mode of weathering. It is an exceedingly tough, massive rock with large phenocrysts of a dark mineral probably hornblende. In weathering, the phenocrysts are acted upon by the atmospheric agencies more energetically than the ground mass, thus giving to the surface a pitted aspect. With the exception of one or two small blasts, no work has been done on the Cole property. It is claimed that this stone admits of a good polish; but, owing to its irregular weathering, it would seem to be unsuitable for exterior work.

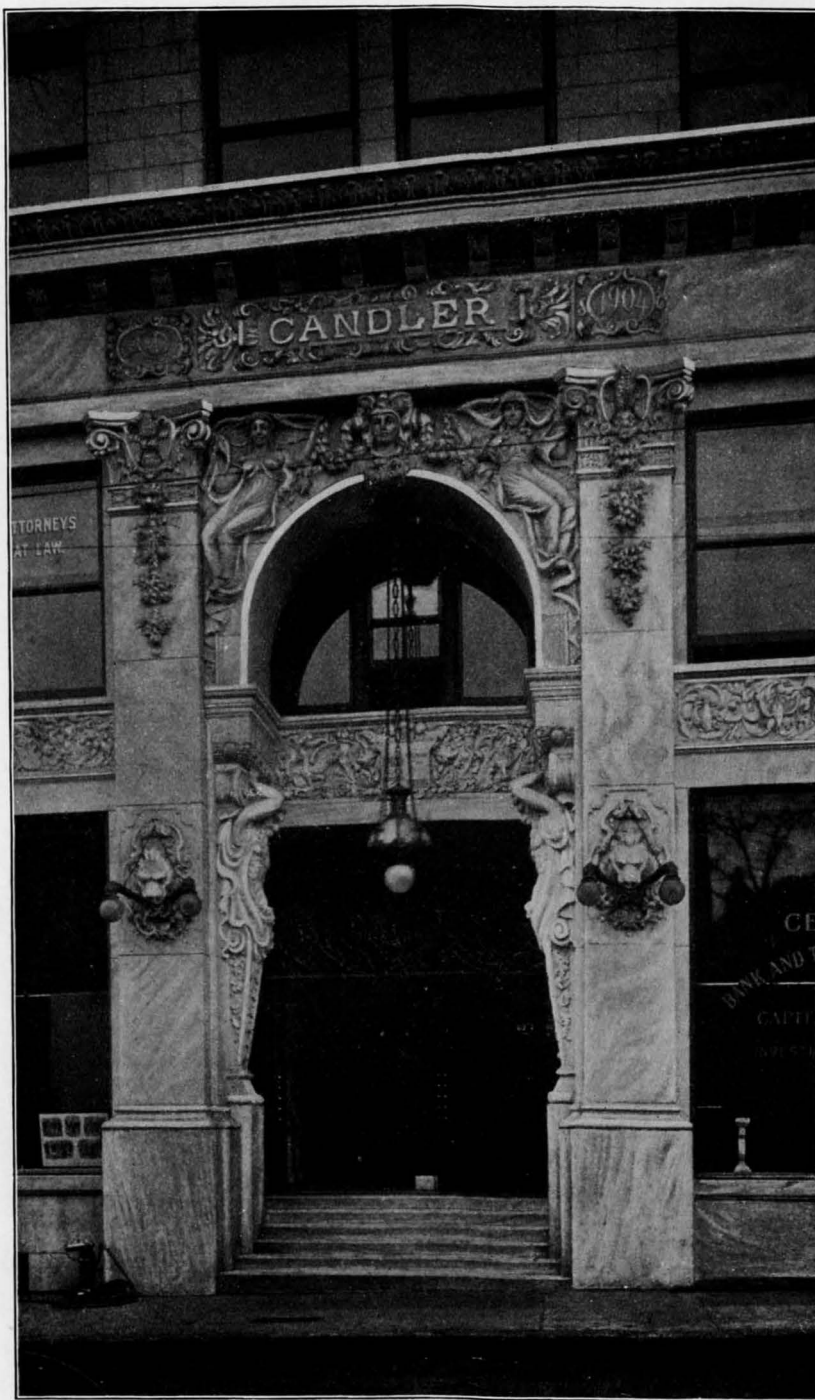
APPENDIX

A LIST OF SOME OF THE MORE IMPORTANT STRUCTURES IN WHICH
THE GEORGIA MARBLES WERE USED PRIOR TO THE PUBLI-
CATION OF THE FIRST EDITION OF THIS REPORT

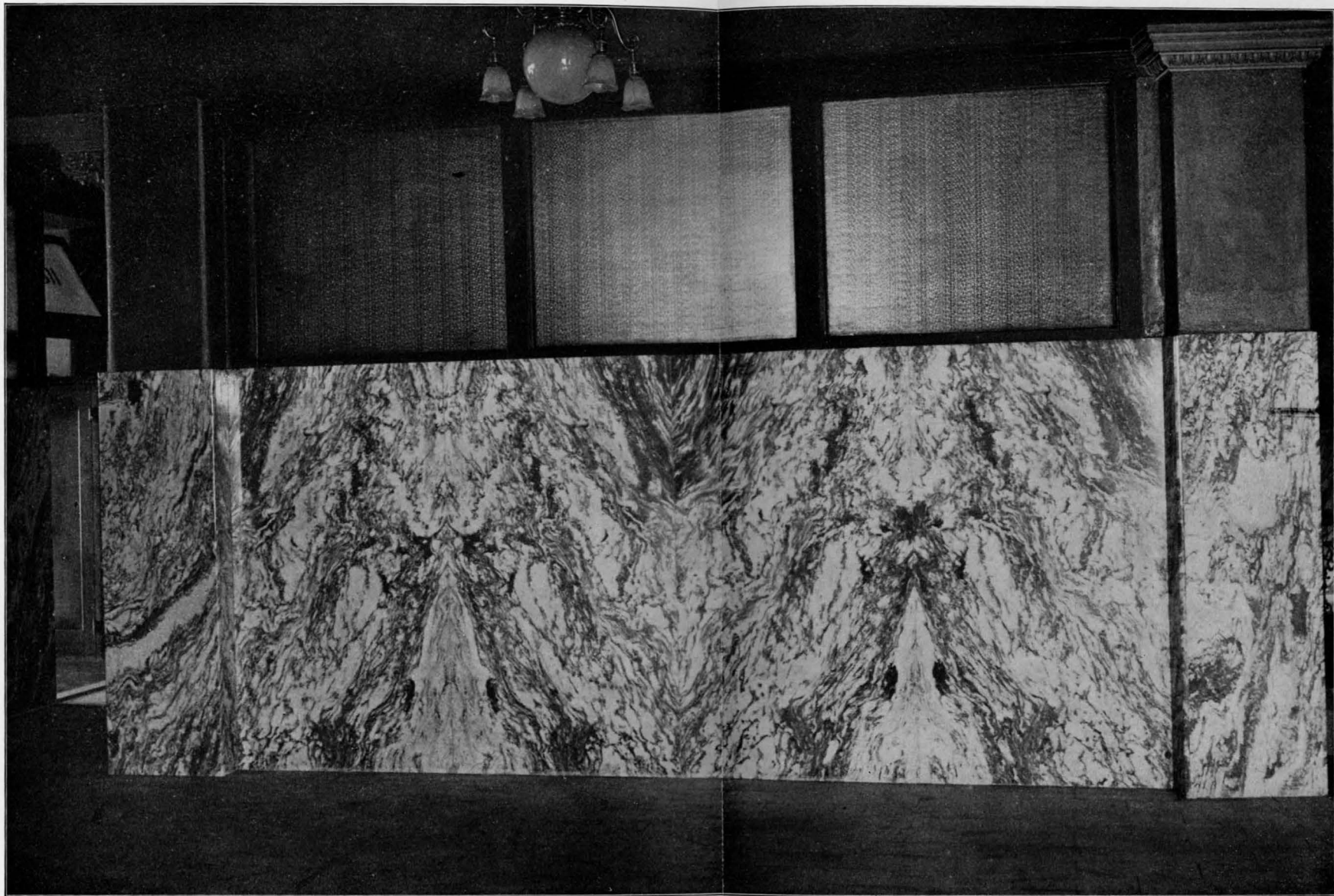
LOCATION	STRUCTURE	EXTENT USED
Boston, Mass.....	U. S. Government b'ld'g.....	4,000 tiles
Knoxville, Tenn.....	Episcopal church.....	Entire building.
Chattanooga, Tenn.....	U. S. Custom house.....	Interior finish.
Chattanooga, Tenn.....	F. F. Marvill building.....	Marble front.
Macon, Ga.....	R. E. Park's building.....	Marble front.
Macon, Ga.....	Coleman & Willingham estate.....	Marble front.
Macon, Ga.....	T. C. Bank's building.....	Marble trimmings.
Macon, Ga.....	Edward Wolff's building.....	Marble front.
Macon, Ga.....	I. O. O. F. building.....	Marble trimmings.
Rome, Ga.....	Floyd county courthouse.....	Marble basement.
Jacksonville, Fla.....	U. S. Government b'ld'g.....	Entire building.
Atlanta, Ga.....	Equitable Building.....	2 stories, entire, tiles and stairs.
Atlanta, Ga.....	DeGive's Grand Opera- house.....	2 stories, floors and wainscoting.
Atlanta, Ga.....	Aragon hotel.....	1 story, floors and wainscoting.
Atlanta, Ga.....	Kimball House.....	5,000 square feet of tiling, etc.
Atlanta, Ga.....	Gould residence.....	Exterior walls.
Atlanta, Ga.....	J. M. High's building.....	Exterior walls.
Atlanta, Ga.....	Jas. L. Dickey's building.....	Marble front.
Atlanta, Ga.....	State capitol.....	50,000 tiles, stairs and wainscoting.
Atlanta, Ga.....	Kutz's building.....	Marble front.
Atlanta, Ga.....	Home for the Friendless.....	{ Basement and trimmings.
Atlanta, Ga.....	Southern Medical College.....	2 stories and trim- mings.

LOCATION	STRUCTURE	EXTENT USED
Atlanta, Ga.....	Grant & Kirkpatrick building.....	Marble trimmings.
Atlanta, Ga.....	Walker Inman building.....	Marble front.
Americus, Ga.....	Bank and Post-office b'ld'g.....	Marble front.
Americus, Ga.....	G. W. Glover's residence.....	Marble trimmings.
Americus, Ga.....	Thornton Wheatley b'ld'g.....	Marble trimmings.
Nashville, Tenn....	Phillips & Butoff building.....	Marble front.
Canton, Ga.....	Bank of Canton.....	Marble front.
Buford, Ga.....	Bank of Buford.....	Marble front.
Elberton, Ga.....	Elberton Bank.....	Marble front.
Louisville, Ga.....	Louisville Bank.....	Marble front.
Perry, Ga.....	Masonic hall.....	Marble trimmings.
Jacksonville, Fla....	W. S. Wear's residence.....	Marble trimmings.
Jacksonville, Fla....	J. J. Green's residence.....	Entire building.
New Orleans, La....	Greenwald hotel.....	Entire trimmings.
New Orleans, La....	St. Paul's P. E. church.....	6,500 feet of tiling and wainscoting.
New Orleans, La....	Cosmopolitan hotel.....	Interior finish.
New Orleans, La....	Kaf T. Hall's store b'ld'g.....	Marble front.
New Orleans, La....	E. G. Wear's residence.....	Marble front.
Newark, N. J.....	Hunt residence.....	Marble front.
Newark, N. J.....	———— church.....	Trimmings and inside work.
Pittsburg, Pa.....	Shield's chapel.....	Entire building.
Savannah, Ga.....	De Soto hotel.....	9,000 feet of tiling.
Savannah, Ga.....	Chatham county c'rt h'se.....	8,000 feet of tiling.
Birmingham, Ala..	Caldwell hotel.....	Trimmings and interior finish.
Chicago, Ill.....	D. K. Kill's residence, 24th street.....	Entire building.
Chicago, Ill.....	Nelson Morison's residence, 45th St.....	Entire building.
Chicago, Ill.....	Wellington hotel.....	6,000 feet of tiling.
North Chicago, Ill..	Residence, 420 N. State St.....	Entire building.
North Chicago, Ill..	Windemere hotel.....	15,000 ft. of tiling.
North Chicago, Ill..	I. G. Well's building.....	Entire building.
North Chicago, Ill..	The Auditorium.....	40,000 feet of wainscoting.

LOCATION	STRUCTURE	EXTENT USED
North Chicago, Ill.	Menoken club-house	Marble trimmings.
North Chicago, Ill.	Peacock Cafe, Madison St	Interior finish.
New York, N. Y.	Criminal court building	Interior finish.
New York, N. Y.	St. Luke's hospital	Entire building.
Brooklyn, N. Y.	St. Cecilia's church	Entire building.
Columbia, S. C.	State capitol	40,000 feet of tiling and base.
Sioux City, Iowa	Fox building	12,000 ft. of tiling.
Fort Worth, Texas	Courthouse	10,000 ft. of tiling.
Fort Worth, Texas	Hendrick's building	12,000 ft. of tiling.
Stephenson, Texas	Earth county courthouse	15,000 ft. of tiling, etc.
Los Angeles, Cal.	Hall of Records	20,000 ft. of tiling.
Los Angeles, Cal.	Library building	12,000 ft. of tiling.
Portland, Ore.	Depot building	5,000 feet of tiling.
Providence, R. I.	Industrial building	20,000 ft. of tiling and base.
Richmond, Va.	Chamber of Commerce	5,000 feet of wain- scoting.
Sherman, Texas	Linz building	5,500 feet of tiling and wainscoting.
Pittsburg, Pa.	Carnegie library	25,000 ft. of tiling.
Boston, Mass.	Ames b'ld'g, Bedford St	Outside trimmings.
Boston, Mass.	Boston public library	Arcade and court.
Boston, Mass.	Ames building, Court St	Interior toilet-room work.
Waverly, Mass.	McLean Asylum	Outside trimmings.
Providence, R. I.	Industrial Trust Co.'s building	Interior finish, etc.
Detroit, Mich.	Pingree building	Exterior of 3 stories
Exeter, N. H.	Saule hall	Interior finish.
Washington, D. C.	Congressional library	100 carloads.
Philadelphia, Pa.	Drexel Institute	Interior finish.
Tampa, Fla.	First National bank	Interior finish.



ENTRANCE TO THE CANDLER OFFICE BUILDING, ATLANTA, GEORGIA,
SHOWING CARVED GEORGIA MARBLE FROM THE AMICALOLA
QUARRIES, PICKENS COUNTY, GEORGIA.



A PANEL OF MATCHED SLABS OF CREOLE MARBLE ON THE FIFTEENTH FLOOR OF THE CANDLER BUILDING, ATLANTA, GEORGIA,
FROM THE QUARRIES OF THE GEORGIA MARBLE COMPANY, TATE, PICKENS COUNTY, GEORGIA.

MARBLE

There was a large increase, from \$6,297,835 to \$7,129,071, or \$831,236, in the value of the marble quarried in 1905 as compared with 1904. The greater part of this increase was from the State of Vermont, although California, Georgia, Maryland, New York, Pennsylvania, Tennessee and Washington each showed also an increase in value of output. The increase was for building stone and for stone used in the interior of buildings, the dressed monumental stone declining somewhat in value.

The total output includes a small quantity of serpentine in Georgia, Washington and Pennsylvania, quarried and sold as marble, and a so-called "onyx" marble, included on account of its similarity of composition and use.

Notwithstanding the enormous quantity of marble capable of being quarried in the United States, from well-developed deposits, and the large number of known undeveloped deposits, a considerable quantity of marble is imported into this country, chiefly from Italy, for statuary and interior decoration, the value of which in 1904 was \$1,186,452, and in 1905, \$1,231,700, an increase of \$45,248, as shown in the table of imports and exports.

Onyx, valued at \$60,518 in 1905, and at \$75,460 in 1904, a loss of \$14,942, was also imported, the greater part from Mexico.

The exports of marble were valued at \$265,023 in 1905 and \$203,086 in 1904, an increase of \$61,937.

The following table shows the value of the marble produced in the United States in 1904 and 1905, by States and uses:

VALUE OF THE MARBLE PRODUCT, 1904 AND 1905, BY STATES AND USES

1904

122

STATE	ROUGH.			DRESSED.					TOTAL
	Building	Monu- mental	Other Pur- poses	Building	Monu- mental	Orna- mental	Interior Decora- tion	Other pur- poses	
Alabama.....									(a)
Alaska.....									(a)
Arizona.....									(a)
Arkansas.....									(a)
California.....	\$ 4,810	\$ 6,073		\$ 7,800		\$ 2,356	\$ 66,620		\$ 87,659
Connecticut.....									(a)
Georgia.....	283,223	227,491	\$ 12,000	108,000				\$ 60,000	690,714
Maryland.....	50,000	23,814							73,814
Massachusetts.....	17,000		14,638	79,472	\$ 1,500	2,000	30,415	38,363	183,388
Missouri.....									(a)
New Mexico.....	600			450		200		3,000	4,250
New York.....	89,971	115,003	10,360	287,830	59,323		3,500		565,987
North Carolina.....					2,741				2,741
Pennsylvania.....	9,031	700	3,200	38,459	24,000		10,000	5,000	90,390
Tennessee.....	53,450	15,000	149,850	50,000	12,000		215,959	9,000	505,259
Utah.....	200	750			3,000				3,950
Vermont.....	732,890	724,812	6,520	397,360	1,100,825	14,750	926,969	100,543	4,004,669
Washington.....	5,000	3,000	1,100	4,000	5,000	498	3,000	1,500	23,093
Wyoming.....	2,000								2,000
Other States.....	36,566			15,300	3,000	1,750	1,500	1,800	b59,916
Total.....	1,284,741	1,116,643	197,668	988,671	1,211,389	21,554	1,257,963	219,206	6,297,835

APPENDIX—Continued

a Included in "Other States".

b Includes Alabama, Alaska, Arizona, Arkansas, Connecticut and Missouri.

1905

Alaska.....					700	10			710
Arkansas.....	750	250							1,000
California.....	4,390	2,075	1,300	5,000	7,575	200	75,000		95,540
Georgia.....	370,047	275,000	72,500	45,421	11,582				774,550
Maryland.....	7,168		3,930	90,782			36,524		138,404
Massachusetts.....	11,622		6,828	15,915			131,995		166,360
New Mexico.....	300			1,500	400				2,200
New York.....	214,023	80,916	13,677	391,037	96,068				795,721
Pennsylvania.....	8,986	750	4,200	59,951	24,000				97,887
Tennessee.....	237,399	830	500	4,000	11,000		323,500	5,000	582,229
Utah.....	600				550				1,150
Vermont.....	903,905	740,117	25,479	554,844	1,015,904	13,433	1,055,632	101,506	4,410,820
Washington.....							60,000		60,000
Wyoming.....					2,500				2,500
Total.....	\$1,759,190	\$1,099,938	\$ 128,414	\$1,168,450	\$1,170,279	\$13,643	\$1,682,651	\$ 106,506	\$7,129,071

APPENDIX—Continued

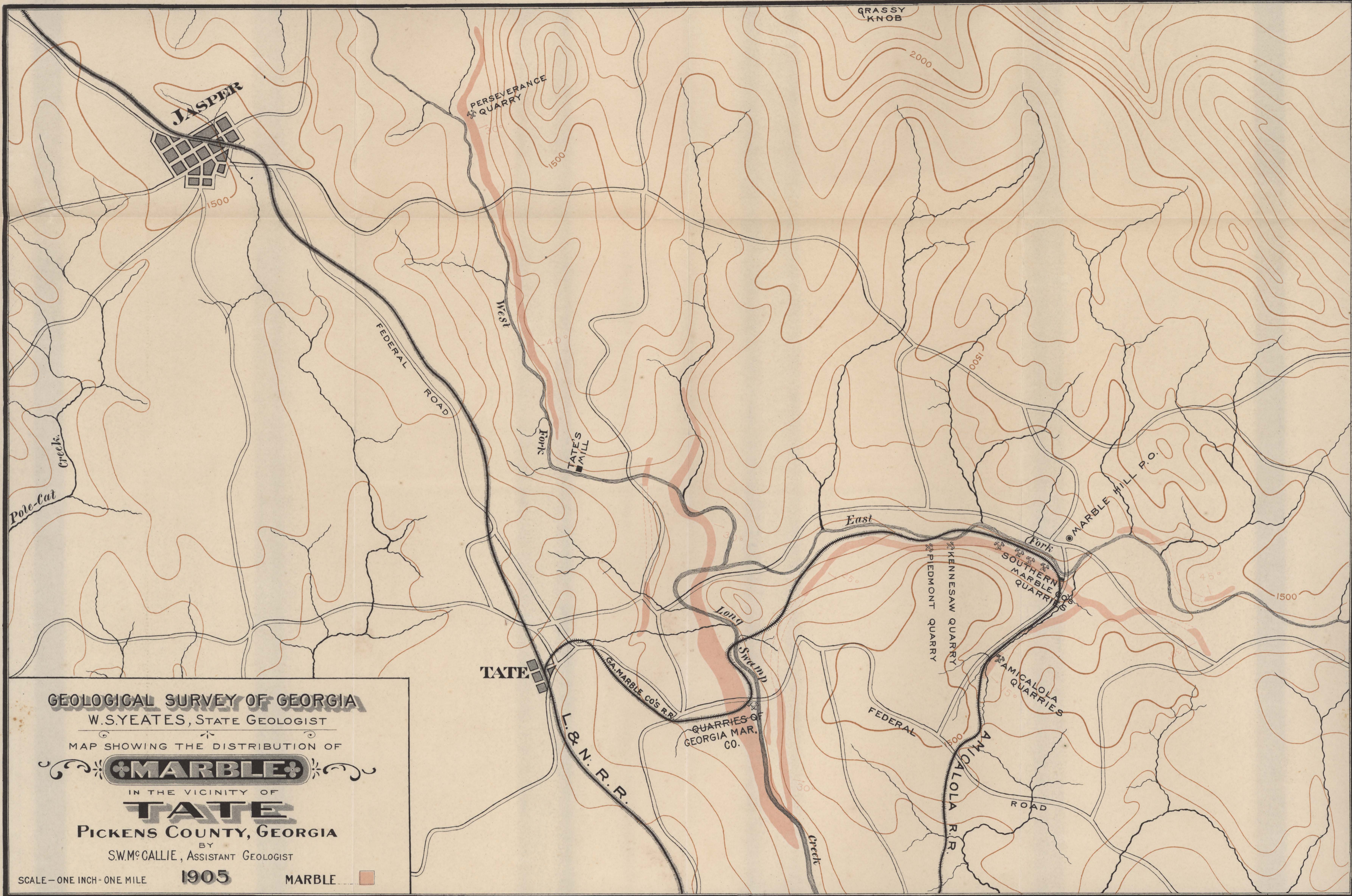


MARBLE COLUMNS AND STAIRCASE IN THE BASEMENT OF THE CANDLER BUILDING, ATLANTA, GEORGIA, SHOWING CARVINGS IN GEORGIA MARBLE, FROM THE AMICALOLA MARBLE QUARRIES, PICKENS COUNTY, GEORGIA.

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GRASSY KNOB

2000

JASPER

PERSEVERANCE QUARRY

1500

1500

FEDERAL ROAD

West Fork

TATE'S MILL

Pole-Cat Creek

East Fork

MARBLE HILL P.O.

SOUTHERN MARBLE QUARRY

1500

TATE

GA. MARBLE CO'S R.R.

QUARRIES OF GEORGIA MAR. CO.

L. & N. R. R.

PEDMONT QUARRY

KENNESAW QUARRY

AMICALOLA QUARRIES

FEDERAL

AMICALOLA R.R.

ROAD

GEOLOGICAL SURVEY OF GEORGIA

W.S. YEATES, STATE GEOLOGIST

MAP SHOWING THE DISTRIBUTION OF

MARBLE

IN THE VICINITY OF

TATE

PICKENS COUNTY, GEORGIA

BY SW. McCALLIE, ASSISTANT GEOLOGIST

SCALE - ONE INCH - ONE MILE

1905

MARBLE